Telecom
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Participant Handbook

Sector
Telecom

Sub-Sector
Passive Infrastructure

Occupation
Customer Service-
Passive Infrastructure

Reference ID - **TEL/Q0102, Version 4.0**
NSQF Level 4

Broadband Technician

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Shri Narendra Modi
Prime Minister of India

Certificate

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STANDARDS

is hereby issued by the

TELECOM SECTOR SKILL COUNCIL

for

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **"Broadband Technician"** QP No. **"TEL/Q0102, NSQF Level 4"**

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Acknowledgements

About this Book

The Indian Telecom Industry is the second largest in the world with a subscriber base of 1.17 bn as of Apr 2022(wireless wireline subscribers). India wired broadband market is projected to grow from around $ 200 million in 2019 to $ 243 million by 2024.

Over the next five years, a rise in mobile-phone penetration and a decline in data costs will add 500 million new internet users in India, creating opportunities for new businesses.

By 2025, India will need ~22 million skilled workers in 5G-centric technologies such as Internet of Things (IoT), Artificial Intelligence (AI), robotics, and cloud computing.

This Participant Handbook is designed to impart theoretical and practical skill training to students for becoming a Broadband technician.

This Participant Handbook is based on Broadband Technician Qualification Pack (TEL/Q0102) & includes the following National Occupational Standards (NOSs):

1. Lay cable/system wiring and install equipment at customer premises
2. Configure customer premises equipment and establish Broadband connectivity
3. Troubleshoot and rectify faults
4. Organize work and resources as per health and safety standards
5. Interact effectively with team members and customers

The Key Learning Outcomes and the skills gained by the participant are defined in their respective units.

We hope that this Participant Handbook will provide a sound learning support to our young friends to build an attractive career in the telecom industry.

Symbols Used

Key Learning Outcomes	Unit Objectives	Exercise	Tips	Notes	Activity	Summary

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1. Introduction to the role of a Broadband Technician

Unit 1.1 - Broadband Technology
Unit 1.2 – Organizational policies and standards

Key Learning Outcomes

At the end of this unit, you will be able to:

- Understand broadband technology
- Know about duties and responsibilities of broadband technician
- Understand organizational standard and policies
- Appreciate size and scope of Telecom industry
- Comprehend process workflow and role of Broadband technician in process

UNIT 1.1: Broadband Technology

Unit Objectives

At the end of this unit, you will be able to:

1. Understand broadband technology
2. Know about duties and responsibilities of broadband technician

1.1.1 Broadband

What is broadband?

The technique which lets any user access the Internet services at higher speeds as compared to a dial-up connection is called Broadband. The speeds vary, subject to the technology set up and the distribution of the levels. Residential services have quicker download speeds when compared to upload speeds.

How does it work?

Information via the Internet is allowed for users through high -speed technology transmission, which is digital, while images, sounds, and text are transmitted as "bits" of data.

1.1.2 Broadband Platform

Broadband can be provided over different platforms, shown in the following figure

Digital Subscriber Line (DSL)	Cable Modem	Fibre
Wireless	Satellite	Broadband over Powerline (BPL)
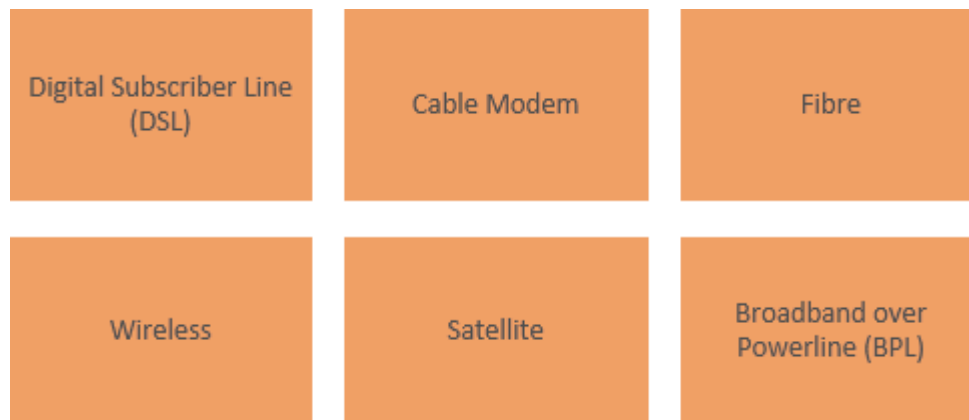
Fig 1.1.1: Different broadband platforms

Digital Subscriber Line (DSL)

Unlike the copper lines installed in homes and businesses, the DSL line transmits data in much faster way. Its transmission speed ranges from several hundreds kbps to millions of bits per second (Mbps)

DSL transmission technologies are as follows:

- **Asymmetrical Digital Subscriber Line (ADSL):** Mainly used in homes (Refer Fig.1.1.1). ADSL provides faster downstream rather than upstream. This sanctions faster data transmission toward the end end-user the same line used for voice service.

Fig 1.1.2: ADSL modem

- **Symmetrical Digital SubSCRIBER Line (SDSL):** Used mainly in commercial set ups, for services like video and voice conferencing. Here both the download and upload speeds remain identical. Faster forms of SDSL include High-data-rate DSL (HDSL) and Very High-data-rate DSL (VDSL).

Cable modem

This allows the operators to deliver Internet (using broadband) at the same time allowing the users to watch TV with a cable connection. The speed and transmission are subject to the quality of cable used, modem, network and the number of users at a given time. Generally, the speeds are equivalent or sometimes surpass the classic residential DSL.

Fibre

Fibre optic cables are used to carry data, which are carried by electric signals to light and sends them to transparent glass fibres. These fibres transform or transfers the data at much higher speeds than DSL or cable modems. The end user speed may fluctuate subject to the distance between the fibre cables and the computer, and also how the service provider has set up the configurations of the service. The fibres, which allow you to access broadband, can also be utilized for delivering voice through VoIP and video services.

Wireless

When a device is connected to the Internet by short-range wireless is called Wireless Fidelity (Wi-Fi). This allows movement to a limited range within a home or business, or can be used in many public places through "hotspots".

A fixed wireless technology when connected with equipment that has a longer range can provide cost-effective Internet service to remote areas.

Mobile service providers also provide mobile wireless broadband services to their customers, although services as compared to a wired or fixed connection is slow.

Satellite

Substituting the wireless broadband is satellite service which is commonly used in remote or thinly populated areas. The speed varies on few dynamics like the provider, service plan, etc. Extreme weather conditions can be a major reason for disruption of satellite service. As compared to dial-up connection speed is faster, however lower if compared to DSL and cable modem.

The key requirements for having satellite service are:

- a base station or dish which should be at least 3 feet
- a clear line of sight (LOS) to the satellite
- a modem

Broadband over Powerline (BPL)

BPL is coming up as a promising technology, which uses existing electrical connections for providing Internet to customer. It has great prospects as the power lines are needed everywhere, mitigating the necessity to set up a broadband for every customer.

1.1.3 Broadband Technician

As a Broadband Technician, you are expected to perform installations, pre-wires, change of service, maintenance, and restoration of telecommunication systems like, Internet services, telephone service and cable television services. As a technician, you will perform services at different levels at the customer location. The service can be to work indoors and outdoors (underground or suspension on power lines).

You are expected to upskill the customer on deliveries, process, and facilities. In addition, provide effective and reasonable service. In addition, you need to be prepared for flexibility of hours worked and overtime required for a task.

Duties and Responsibilities

- Demonstrate and explain customer about use of installed products and apprise on service information
- Installs, maintain or repairs, and tests residential/business (including under construction) telecommunication
- Analyze and troubleshoot technical challenges
- Be present at required technical, safety and team meetings
- Provide customer service at all levels
- Properly maintain and organize company vehicle/equipment
- Preserve records of installations, repairs and maintenance

1.1.4 Size & scope of Telecom industry and its various subsectors

India is the world's second-largest telecommunications market. The total subscriber base, wireless subscriptions as well as wired broadband subscriptions have grown constantly. Total broadband subscriptions grew to 792.1 million until December 2021 and total subscriber base stood at 1.18 billion in December 2021.

Gross revenue of the telecom sector stood at Rs. 64,801 crore (US$ 8.74 billion) in the first quarter of FY22.

The total wireless data usage in India grew 16.54% quarterly to reach 32,397 PB in the first quarter of FY22. The contribution of 3G and 4G data usage to the total volume of wireless data usage was 1.78% and 97.74%, respectively, in the third quarter of FY21. Share of 2G data usage stood at 0.48% in the same quarter.

Over the next five years, rise in mobile-phone penetration and decline in data costs will add 500 million new internet users in India, creating opportunities for new businesses. By 2025, India will need ~22 million skilled workers in 5G-centric technologies such as Internet of Things (IoT), Artificial Intelligence (AI), robotics and cloud computing. *(Information sourced from www.ibef.org)*

UNIT 1.2: Organization Policies and Standards

Unit Objectives

At the end of this unit, you will be able to:
1. Understand the policies on incentives
2. Explain the delivery standards defined by the organization
3. Explain the standards for personal management
4. Understand the norms for public relations

1.2.1 Organizational policies

Incentives

Offering people, a reward for good work will motivate them to put in extra effort. If you provide subpar work, the result is frequently that you will be dismissed and have to lose your benefits as well as your salary. But how can one inspire (or reward) someone to produce their finest work? The answer is based on the company's culture, the person's needs or preferences, and the options available.

Most of the companies these days link the performance of the employees to incentives to motivate them and encourage them to give their best to the organization. Cumulative effort from the entire team would make a great impact on the organisation's business goals.

Characteristics of Incentive Plan:
   a) There is a direct link between incentives and performance.
   b) Rewards encourage employees to achieve at their highest possible level as opposed to their current level.
   c) It boosts productivity by assisting in the advancement of technology.
   d) Financial measurements can be made of incentives.
   e) The inception of effective incentive plans, including the timing, precision, and frequency of incentives.
   f) An incentive program boosts attendance and lowers absenteeism.
   g) According to each individual's performance, incentives differ.
   h) All employees are entitled to the minimum wage.

Written codes of behaviour known as customer service policies provide personnel with rules to abide by in a variety of customer service situations. For instance, you might have a policy for how to handle refunds or how to respond to consumer inquiries. Written policies are established to instruct your staff on customer service procedures and the right actions to take in different circumstances.

Customer service rules assist your employees in adhering to a regular procedure, such as determining the most expedient way to fix problems or respond to frequently requested queries (FAQs). They assist you in continuously enhancing your customer service while keeping everything as structured and efficient as they can be.

Fig. 1.2.1: Customer Service Desk

Customer service policies may include a number of details based on your industry and needs. Typical examples are:

- Product and service description: Describe the goods and services your business provides in general terms. You can include illustrative videos, written explanations, and articles that are updated frequently.
- Workflows for customer service: What is acceptable and what is not? What steps are involved in onboarding a new customer? These workflows are defined and laid out in detail by your customer service policies. They are essentially instructions for usage for customer care agents.
- Benchmarks for customer service include: A customer service policy incorporates industry-recognized standards to aspire for, as was previously said.
- Customer service commitments: These represent the guiding principles of your business. When you are honest about the services you provide, your customers will trust you more.
- The administrative task of assessing and categorizing the human resource requirements for achieving organizational objectives through the interaction of individuals at work is known as **personnel management.**
- In personnel management, tactics are used to guarantee that there is the ideal mix of talent, education, and work performance.

The following are some examples of the broad range of personnel management:
- Organizational Planning and Development
- Staffing and Employment
- Training and Development
- Compensation, Wage and Salary Administration
- Employee Services and Benefits
- Employee Records
- Labour Relations, and
- Personnel Research and Personnel Audit

Public relations (PR) refer to the range of actions taken by a business to advance and safeguard the public's perception of the business, its policies, and its products. Thus, it seeks to control how the public perceives the organization.

Public Relations should not only be an addition to advertising but also a significant yet understated component of the promotional mix.

The following are the most significant gains:
- Credibility – The credibility element is significantly increased if the public learns about the advantages of a company's products through an independent source that is not receiving payment from the company in question.
- Greater readership – When perusing a newspaper, adverts rarely receive the majority of the reader's attention. Editorial or news sections receive a lot more attention. Similar to this, when advertising are on television, viewers are more inclined to turn away and do something else.
- Contain more information – The public can learn more from public relations than from advertisements. An advertisement typically just receives a cursory glance, but when presented as news, public relations receive more attention and is therefore able to provide much more extensive information.
- Cost benefits – The media is not paid directly for public relations work. Obviously, there are expenditures involved, but budgets for PR are much smaller than those for advertising.
- Speed – The advantage of public relations is its quickness. An important development's information can frequently be released and publicized in a short period of time. Additionally adaptable and responsive are public relations.

Escalations can be scary. Often, when people hear of a customer issue being escalated, they can't help but think of churn. In today's customer-focused economy, unhappy customers can quickly move on to a new product or service. This leaves many companies looking for a quick solution to customer issues. As scary as escalations can be, they can also be beneficial.
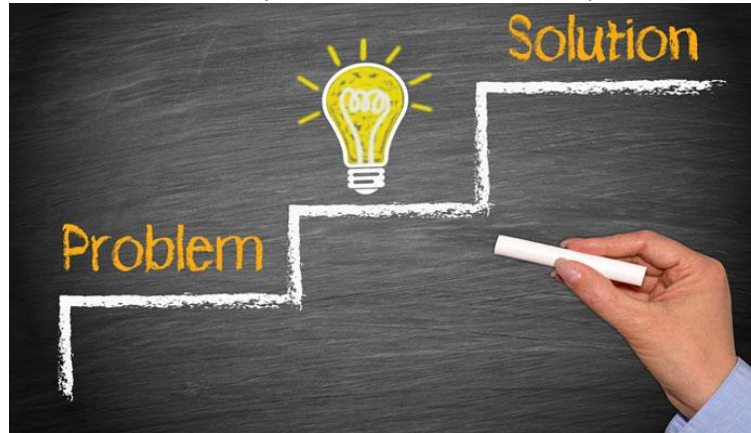
Fig. 1.2.2: Identify solution for a problem

When it comes to escalations, your main priority should be how to leverage the circumstance to win over clients' trust and faith. In a perfect world, you would reduce the number of escalations, rapidly settle open escalations, and maintain customer confidence both during and after the escalation.

1. **Be prepared for the inevitable.** You know hot situations are going to happen, so get the process in place as best you can, line up all the right people and organizations that you anticipate you're going to need to help out. Make them part of that build, do a dry run review, document it and make sure the process is ready and you're ready for when it happens. That way you'll be well rehearsed and understand what to do.

2. **Be proactive.** A lot of escalations come from either panic or the unknown, so prepare your customers by introducing the people that will handle their issues ahead of time, and let them know that you have a process in place for when issues do arise.

3. **Have a closed loop mechanism and drive continuous improvement.** Rarely are escalations a one-off problem. Be sure you have a process in place to review what happened, what you can do better in the future, and what you can do to make sure it doesn't happen again, both for your customers' sake and so you're not burning out internal team members on firefighting.

4. **Empathize, apologize, remediate, communicate, and follow up.** Communication is key when dealing with escalations. Be sure you're talking to your customers about what is happening, and how you're fixing it. And be sure after the issue is resolved, to follow up with what your organization is doing to make sure it doesn't happen again in the future.

5. **Get and share context.** Find out from your customers why the issue is creating such a problem for them. Not only will this give you important information about how urgent it really is, you can share this context about the business impact internally to help drive remediation.

6. **Use escalations as an opportunity to build trust.** When handled correctly, escalations will show your customers that they can trust you, which will increase retention rates.

Tips

- The electrical signals carrying data are converted in to light beam by fibre optic technology and the light is sent through transparent glass fibres with diameter of a human hair.

- A user must have a satellite modem Internet, for satellite broadband.

- Cable modem service offers the facilities to the cable operators to provide broadband over the same coaxial cables, through which pictures and sound are delivered to your TV set.

Exercise

1. List down the roles and responsibilities of Broadband Technician.

_____

_____

_____

_____

2. What do you mean by broadband technology?

_____

_____

_____

_____

3. What do you mean by ADSL and SDSL?

_____

_____

_____

_____

Exercise -1: Multiple Choice Questions

1. Wifi stand for _____
   a) wireless function
   b) wireless fidelity
   c) wireless functioning
   d) none of the above

2. For transmitting signals_____ waves are used in a wireless network.
   a) sound
   b) Mechanical
   c) radio

3. Which is the slowest Internet connection?
   a) Land Line
   b) Dial-up service
   c) Cable modem
   d) Digital subscriber line

4. The equipment needed to allow home computers to connect to the Internet is called a
   a) Modem
   b) Gateway
   c) Monitor
   d) Peripheral

2. Install Cable/System Wiring and Equipment at Customer Premises

TEL/N0111

Key Learning Outcomes 💡

At the end of this unit, you will be able to:

1. State the knowledge about cables and connectors
2. State the process of cable laying and its connection methods
3. Understand customer premise equipment like modem, router, and switches
4. Execute and demonstrate the procedures for equipment installation
5. Execute and demonstrate the procedures for UPS installation
6. Understand how to check Voltage, current and earthing
7. Understand how to check and test battery
8. Execute installation and repair of UPS
9. Learn basic load calculation
10. Understand about UPS and Battery compatibility
11. Understand the importance of record-keeping and documentation

UNIT 2.1: Cable and Connectors

Unit Objectives ◎

At the end of this unit, you will be able to:

1. Work with cables
2. Use connectors

2.1.1 Networking Cables

The medium through which information travels from a specific network to another network is called cable. The cables that are used to connect a specific device to another device within a network are called networking cables. The type of cable chosen for a network depends upon protocol, network's topology and size.

The following figure shows the classification of network cables:

Twisted Pair Cable

Coaxial Cable

Fibre Optic Cable
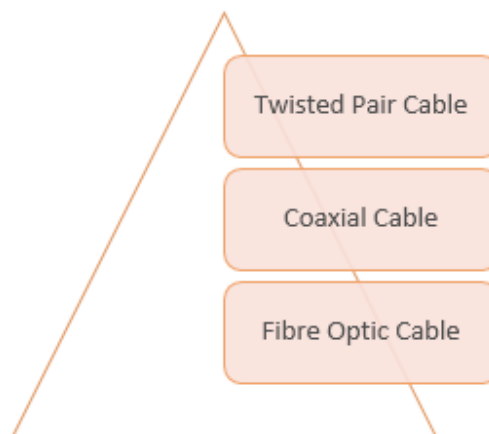
Fig 2.1.1: Classification of network cable

Twisted Pair Cable

In twisted-pair cables, copper wired cables are twisted together to reduce inter and intra Electro Magnetic Interference (EMI). These cables are mostly used for Ethernet networks.

These can further be classified as follows.

Unshielded Twisted Pair (UTP) Cable

UTP Cable has two undefended wires twisted around each other. Being cost effective this type of wire is widely used for local-area networks (LANs) and telephone connections. The quality of UTP varies from telephone wires to high-speed. To eliminate intrusion with neighboring pairs and other devices each UTP cable is twisted with a different number of rotations per inch. The better the twisting, the higher the transmission rate and cost/foot.

The following figures shows UTP cable:

Fig 2.1.2: UTP Cable

Shielded Twisted Pair (STP) Cable

STP has wiring of copper wherein each of the two copper wires are twisted and coated with insulating coating and every pair of wire is individually shielded with foil that functions as a ground for the wires. STP cabling is majorly used for Ethernet networks, specifically for fast data rate Ethernets.
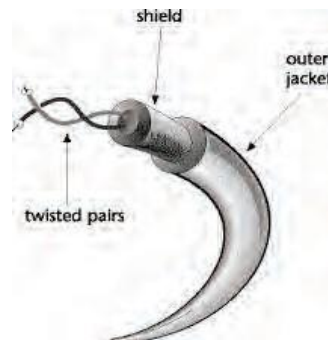
Fig 2.1.3: Shielded Twisted Pair Cable

Coaxial Cable

Coaxial cabling consists of copper conductor surrounded by dielectric insulator which is surrounded by braided metallic shield. Metallic shield is covered by layer of plastic which provides insulation between metal shield and the conductor. It is helpful in blocking intrusion from outside.

Fig 2.1.4: Coaxial Cable

There are two types of coaxial cables:
1. Thick coaxial cable
2. Thin coaxial cable

Thick coaxial cable

The specification of thick coaxial cable is 10Base5. The number 5 signifies the length of the segment as 500meters. The outer plastic covering prevents the moisture to get in contact with the conductor; because of this it is preferred for long-running lengths. These cables do not twist easily and is difficult to mount.

Thin coaxial cable

The specification of thin coaxial cable is 10 Base2. The number 2 signifies the length of the segment as 200 meters. They are commonly used in school network.
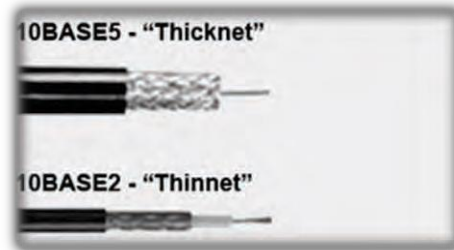
Fig 2.1.5: Thick and Thin Coaxial Cable

Fibre Optical Cable

To prevent interference, any optical fibre has a glass core in center, surrounded by numerous coatings of material for protection which is further topped with an outer layer of PVC jacket or insulating Teflon. This is for sure an expensive method when compared to others available in the market, but it has proven to be efficient in transmitting data in longer distances while ensuring good speed. This further in helpful in video conferencing and different interactive facilities.
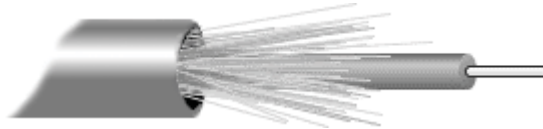
Fig 2.1.6: Fibre Optic Cable

The two types of fibre optic cables are as follows:
1. Single mode
2. Multimode

Single mode cables can provide more distance in comparison to multimode cables and is expensive, whereas, **Multimode** cables has larger diameter than single mode cables, however, both cables provide high bandwidth at high speeds.
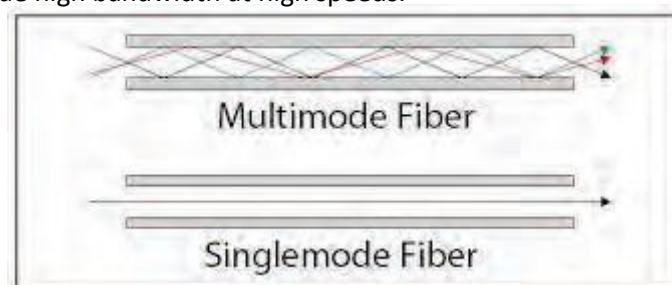
Fig 2.1.7: Single mode and Multimode Fibre

2.1.2 Connectors

A connector is a device required for connecting one device to another through interfacing of cable that plugs into a port.

Commonly used connectors are as follows:
- Registered Jack 45 (RJ45)
- Straight Tip (ST) Connector
- Lucent Connector (LC)
- Multi-fiber Push On (MPO)

RJ-45 Connector

It is an eight-wire telephone-type connector used with twisted-pair cabling for connecting computers, wall plates, patch panels, and other networking components. It is generally used with unshielded twisted-pair (UTP) and shielded twisted-pair (STP) cabling in star-topology Ethernet networks.

Fig 2.1.9: RJ-45 Connector

Straight Tip (ST) Connector

This is a straight tip, a high-performance fiber-optic connector with round ceramic ferrules and bayonet locking features. It is more commonly used than subscriber connector. These are getting slowly replaced by multi-fiber connectors (Lucent Connector and Multi-fiber Termination Push-on)

Fig 2.1.12: ST Connector

Lucent Connector

To terminate multiple fibers from high-density positioning, Lucent Connector (LC) was manufactured. LC connector is twofold connecting a pair of fibres.

Fig 2.1.13: LC Connector

Multi-fiber Push On (MPO)

MPO is also duplex connector for easy connections as it is designed to connect several times without any challenges. It is also known as Multi – Fibre Termination (MTP).
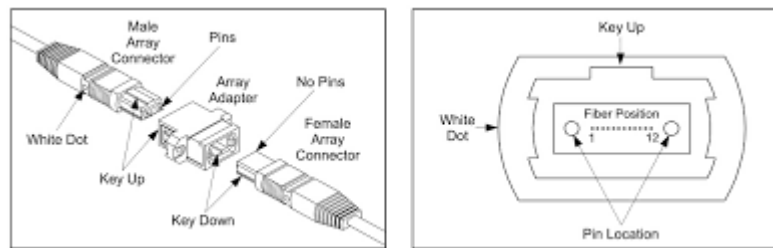
Fig 2.1.13: MPO Connector

Tip

- Information usually moves from one network device to another through a cable
- Twisted cables are twisted together to cancel out inter and intra Electro Magnetic Interference (EMI)
- Lucent Connector (LC) was industrialized for high-density arrangements
- RS-232 is a standard for serial data transmission in telecommunications

Exercise ✎

1. Explain different types of cables and their importance.

_____
_____
_____
_____

2. Why connectors are used for cabling? Justify

_____
_____
_____
_____

3. What is fibre optic cable?

_____
_____
_____

Fill in the blanks:

1. _____ is used to connect the computer parts to the mains supply.
2. _____ is used to establish connectivity between computers
3. Which cable is used to transmit High-Definition Signals? _____

UNIT 2.2: Cable Laying and Connectorization

Unit Objectives ⊚

At the end of this unit, you will be able to:

1. Understand the cable laying process
2. Understand the process of cable connection methods

2.2.1 Structured Cabling

A Structured Cabling system comprises of a set of transmission items that are collaborated with Engineering design rules. This assists in applying voice, data, and signals to maximize data rates. This technology divides the infrastructure into controllable blocks to get high-performance Network system, which is currently prevalent.

This is the most effective technology to cater to the requirement of telephone and data communication currently and will prevail in future.

The following figure lists the components of structured cabling system:
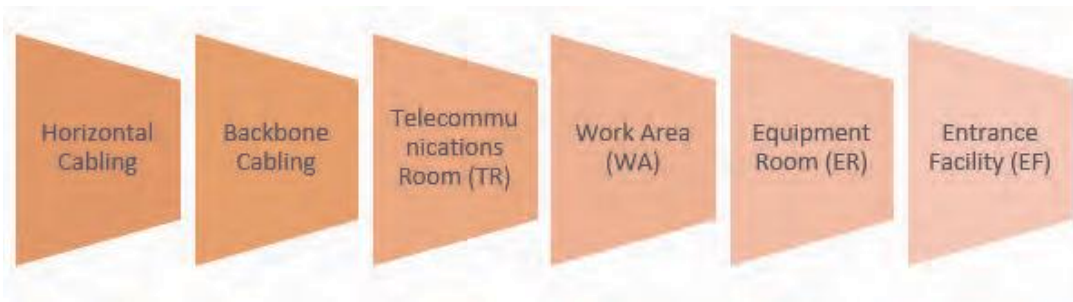
Fig 2.2.1: Components of structured cabling system

Horizontal Cabling

Any cabling, which connects floor's wiring, closed to wall plates to furnish local area network for connecting end user system to network. It is generally installed in star topology.

Backbone Cabling

It lays an association between telecommunication rooms, equipment rooms and entrance facilities. It is also called vertical cabling.
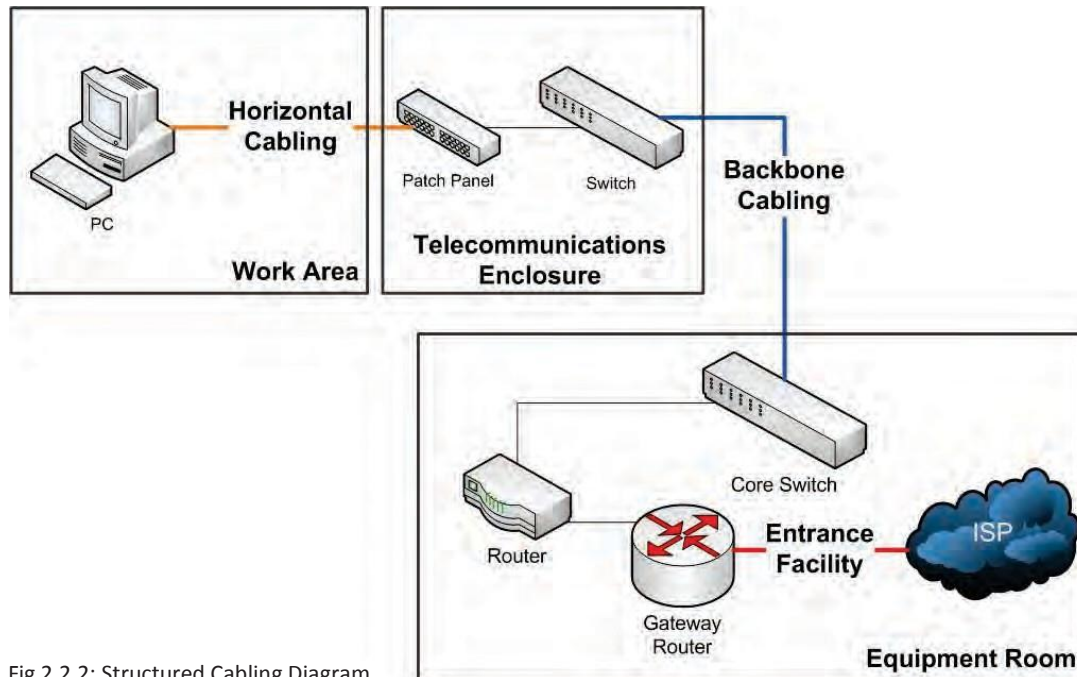
Fig 2.2.2: Structured Cabling Diagram

Telecommunication Room

The area where the horizontal wiring and the backbone wiring are connected is called as telecommunications room. Each structure should have a minimum of one telecommunications room, preferably per floor where it's providing the connection.

Work Area

This includes all components between the outlets of a telecommunication room to the user's workstation. It is where an individual works on his system with an attached peripheral.

Equipment Room

As the name suggest, it's a room where the cables and other accessories connects with its respective electronic equipment. The complexity of the components in equipment room makes it different than telecommunications room.

Entrance Facility

The area where internal and external cables connect. External cabling like, telecommunication providers, inter-building cables and antennae pathways.

2.2.2 Decision Factors in Choosing Cable for a Network

- **Topology** plays a critical factor in determining hardware and cables types to set up networking infrastructure

- **Bandwidth** is the amount of data that needs to be transferred at a given time. In any specific network, the cable with greater bandwidth provides faster information transmission

- To send the information without the use of equipment, a cable with higher **signal attenuation** is required in order to increase electric signal

- To avoid **EMI (Electro-Magnetic Interference)** while using appliances like photocopiers, fluorescent lights, and electrical wiring EMI resistant cables are preferred

- Easy installation and need for setting up additional equipment define **expansion capabilities**

2.2.3 Connectorisation

TIA/EIA 568A Wiring Sequence

In both the 568A and 568B sequences, pair 1 and pair 4 refer to the blue wires and brown wires respectively. The following figures show the connections:

Pair 1 is allocated to pins 4 and 5.

- Blue wire connects to pin 4, as a ring (R) wire
- White wire of the blue pair connects to pin 5, as an IP (T) wire.

Pair 4 is allocated to pins 7 and 8 of the connector.

- The white wire of the brown pair connects to pin 7, as the IP wire
- The brown wire connects to pin 8, as the ring wire.

R4-8 Brown — Pair 4
T4-7 White/Brown
R2-6 Orange
T1-5 White/Blue — Pair 1   Pair 2
R1-4 Blue
T2-3 White/Orange
R3-2 Green — Pair 3
T3-1 White/Green

R = Ring, or Recieve
T = Tip, or Transmit
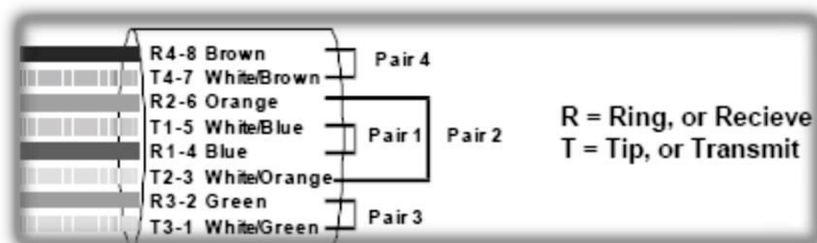
Fig 2.2.3: Wiring Sequence 1

The terms IP and ring are classic terms used for labelling the IP and ring (The retort is what is heard on the recipient end once the number is dialed).

If the network is set in a way that it uses 10 Mbps bandwidth, you may not need to use the blue and brown sets. In a scenario like this you may use the blue pair for transmission of voice and for network roles, use the brown pair. The position of pins numbering 1,2,3 and 6 which are the green and orange sets are categorically used for transmitting Ethernet through Pin 1 and pin 2 for receiving, number 3 and 6 pins sets are used.

TIA/EIA 568B Wiring Sequence

In the T568A arrangement, pin number 1 and 2 is allocated to the green pair while the orange pair is divided between pin 3 and 6. In T568B order is an opposite arrangement of T568A where the green pair splits between 3 and 6 pin, and the orange pair is allotted to pins 1 and

Fig 2.2.4: Wiring Sequence 2

Pairs 2 and 3 are ASSIGNED to Different PINS
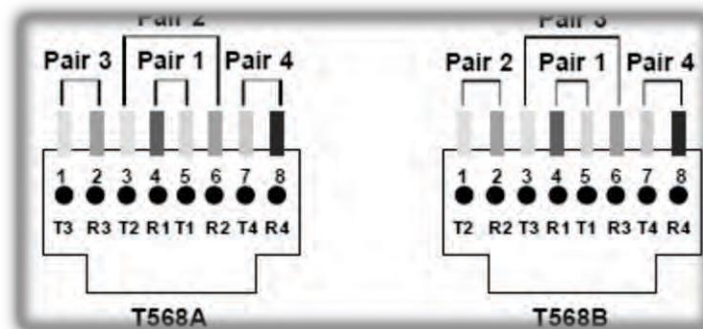
Fig 2.2.5: Wiring Sequence 3

We will discuss this topic further in coming sessions as well.

Crimping Cable

Cut, stripe, and crimp an exposed pair of category 5 cable, and attach to RJ-45 connector. After the completion of this task, you will be required to test your cables for connection.

Required Materials

• Category 5 UTP Cable
• Two (2) RJ-45 Connectors Crimping Tool (model 24 -4680P, or equivalent)
• Cable Tester (Brand and model in equipment package, or equivalent)

Procedure

Keep a record for portfolio. While following these steps record problems and major observations.

To become a suitable candidate for employment one must be aware of the conversing issues and solutions, using the following steps:

1. Compare individual crimping tool with the one illustrated below. The image shows a tool with blades for cutting and stripping and connectors RJ-45 and RJ -11, which is used mainly for six wire telephone cable. In case all the given features are not available in a particular crimping tool, then in such situation one may need to use two or more tools, for example, a separate wire cutter and/or stripper.
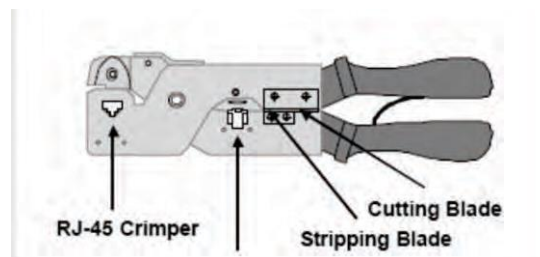
Fig 2.2.6: Crimping tool – Parts

2. Cut the category 5 UTP is specified length. Ends should be cut in square rather than diagonal. Insert the cable in between the cutting blades and close the blades after squeezing the crimper handle firmly.
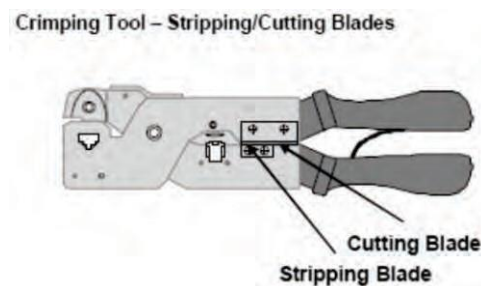
Fig 2.2.7: Crimping tool – Blades

3. To strip of the outer covering, one must pull -out the end of the cable with the backstop. The stop plays an important role in averting more insulation from the cable. Now jam with an uninterrupted pressure but be careful while applying the pressure as to much of it will cut the wires. Next the plastic insulation shield should be revolved to cut the wire.

4. You should have four pairs of wires which makes a total of eight single wires, if you don't have these number then the missing number was accidentally cut while stripping and, in such case, you will have to repeat point number 3.

5. Carefully observe the RJ-45 connector. One will be able to see the two sides:
   • one side shows the plastic locking clip
   • other side will show eight metallic pins.
   The pins will be marginally raised above the surface.

6. Be careful and observant while inserting these eight wires into the connector.
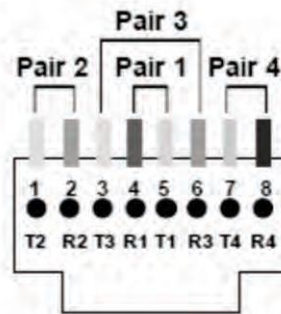
Fig 2.2.8: T568B Wiring Sequence

7. Ensure every wire fits in their eight separate respective slots. To ease this process, separating the wires is recommended.

8. Insert the cables with a firm and steady pressure. Each wire at the end must reach the metal pin of the connector.

9. The complete assembly of connector should reach RJ-45 slot. In order to fold these wires one can use the teeth of the crimper.

   We will discuss crimping further in coming sessions as well.
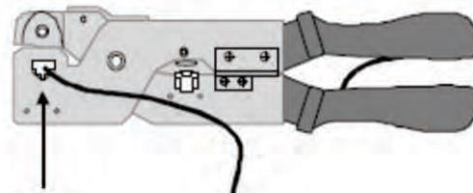
Fig 2.2.9: RJ-45Crimper

10. To check if the respective wire is crimped as desired, check the metal pins. If they are not raised on the connector that means they are cut in the desired manner, if not then redo the same process.

11. Be sure to record the colour sequence of these wires on the sheet with the right sequence. Use the portfolio-recording sheet for filling the colour sequence as revealed in below table. Hold the connector in such a way that the metal contact pins are facing you and the locking clip are on the other side. Record the wire colours from each end.

Pin 1 Colour	Pin 2 Colour	Pin 3 Colour	Pin 4 Colour	Pin 5 Colour	Pin 6 Colour	Pin 7 Colour	Pin 8 Colour

Fig 2.2.9: Recording the colours

12. For the other end of the cable, repeat steps 3 through 11.

Pin 1 Colour	Pin 2 Colour	Pin 3 Colour	Pin 4 Colour	Pin 5 Colour	Pin 6 Colour	Pin 7 Colour	Pin 8 Colour

Fig 2.2.10: Re-recording the colours

13. Present your cable along with the table for the wire colour to your instructor for inspection and clearance for testing using the cable tester.

Tips

- Structured cabling differs depending on infrastructure, type of equipment, existing cabling system, customer requirements, manufacturing, and functionalities of cabling installation
- Crimped connectors can be attached on coaxial cable or Ethernet cables

Exercise

1. Write down the steps of cable crimping.
   _____
   _____
   _____
   _____
   _____

2. List factors to be decided to choose the cable for a network.
   _____
   _____
   _____
   _____
   _____

Fill in the blanks:

1. _____ is the amount of data that needs to be transferred at a given time.
2. Topology plays a critical role in determining _____ and _____ to set up networking infrastructure.

UNIT 2.3: Customer Premise Equipment

Unit Objectives ⊚

At the end of this unit, you will be able to:

Understand customer premise equipment like modem, router, and switches

2.3.1 Modem

A modem is a hardware device that converts binary signals to analog auditory signals and allows transmission over the telephone lines. Data is transmitted in an intermittent packet and at the receiving end data is extracted from packets and reassembled.
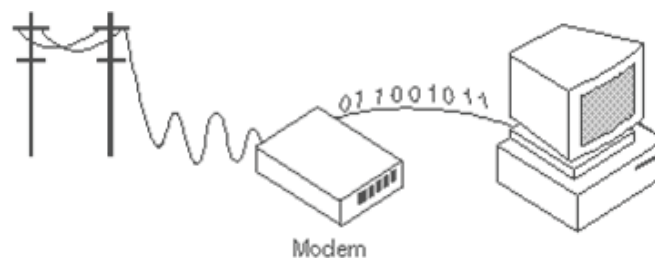
Fig 2.3.1: Modem

Modulation is converting to an analog signal. **Demodulation** is the reverse process of converting the analog signal back to binary signal.

For better understanding let's take the following example:

Consider a computer that has been given a command to view a website/webpage on a browser. A digital request is accepted by the modem from the computer, which further alters it to an analog signal. The answer to the request in analog form, returns to the modem, once the request is accepted. The answer signal is, converted to digital form by the modem, and finally sent it back to the computer. In simple words a modem converts an analog signal to digital.

It may strike you why there is idleness in converting analog to digital signals. The simple answer is– telephone lines have limitations while carrying digital signals and on the other hand our computers are limited to only understand 1s and 0s, as the digital signals. The solution is explained further.

Modem Types

- External - connected outside system using a serial cable
- Internal - mounted to an expansion slot of motherboard
- Wireless – connected without cable; uses radio frequency to transfer data
- Dial-up – connected through ISP to computer using telephone line

- Cable – system communicates with ISP over a landline connection
- DSL - connect to a computer or router through Ethernet or USB port
- Satellite – uses satellite technology for data transmission
- Half – duplex - sends and receives signals in an alternate fashion
- Full – duplex - capable of consecutively handling two separate signals at the same time while using two carriers each of which transmits and receives data

How does a modem work?

A modem holds the following three components:
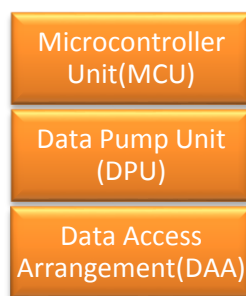
Figure 2.3.2: Components of Modem

Microcontroller Unit (MCU) – It is required for data compression and error checking. It also converts parallel transmission to serial.

Data Pump Unit (DPU) - It communicates with ROM and receives commands and settings.

Data Access Arrangement (DAA) – It acts as an interface to Public switched telephone system (PS

Figure 2.3.3: Components of Modem

2.3.2 Router

Hardware that is used to route data from local area network to a specific network connection is called a Router. Data here refers to files, communications, and transmissions. Most of these routers keep logs of the activity of the particular network.

Routers yield information through broadband signals via a modem then decode it and further deliver it to the computer. It is capable of reading sender's details, data type, size, Internet Protocol address (IP address).

Since a router can connect two or more networks and runs on OSI (Open Systems Interconnection) model that's the reason it's called a Layer 3 gateway device.

Usually, residents use wireless or wired Internet protocol router. The home local area network (LAN) is connected to a wide-area network (WAN) via either a DSL or cable modem.

TYPES OF ROUTERS

Core router

They are used by service providers (i.e., AT&T, Verizon, Vodafone) or cloud providers (i.e., Google, Amazon, Microsoft). Large enterprises use these routers as they have the capability of generating maximum bandwidth to connect across.

Edge router

They are known as gateway as they are connected with external networks. They are used for optimizing bandwidth and connect to other routers for distributing data.

Distribution router

It receives data from wired connection and shares it with users via Wi-Fi.

Wireless router

It is a combination of edge routers and distribution routers. They are commonly used for home networks and access to Internet.

Virtual router

To cater to large business needs where complexities are high, these routers provides services in the cloud.

Click the QR code to understand how to install a router

2.3.3 Modem vs. Router

Parameters	Modem	Router
Definition	It is a device that modulates and demodulates the electrical signal and maintains a dedicated connection between the Internet and network	It is a networking device that enables multiple devices to connect to wired or wireless networks
Operating Layer of OSI model.	It works on the data link layer of the OSI model	It works on the physical, data-link, and network layers of the OSI model
How does it work?	It modulates the electrical signal to a digital signal and sends it to system, demodulates the signal from digital to analog, and sends it to the Internet	It follows routing table to transfer data packets from one source to another. It permits several network devices to connect over the network
Security	There is no authentication check happens for the data	There is complete security through passwords to transmit data packets over a network.
Cable Used	RJ45 is used to connect with router and RJ11 to connect to telephone line	RJ45 cable is required
Placed	Between the telephone line and computer or router	Between modem and other networking devices
Internet Access	Essential to access the Internet as it connects the ISP to system	One can access Internet without using a router
Number of connected devices	Connected to only one device that can be either a computer or a router	Can connect to multiple network devices using Ethernet cable or Wi-Fi
Ports	Essentially two ports are required	Can have 2 to 4 ports

2.3.4 Network Switches

Network switch is a hardware or software-based device that connect devices in a network to each other and transmit data packets. Devices such as printers, computers and servers, which are placed within premises or at a particular site. It acts as a controller, permitting networked devices to connect to each other efficiently, thereby increasing productivity of employees.

On an Ethernet LAN, from the physical address of a device, called MAC (Media Access Control) address in each incoming message frame, a switch determines which output port to forward it to. In Internet which can be considered as wide area packet - switched network, a switch figures out which IP to use for its next destination travel.

Fig 2.3.7: Network switches

In the Open Systems Interconnection (OSI) communications model, a switch makes the route easier by simply identifying the data unit through its physical address and moves it towards that device. Newer switches that start performing the routing functions are at times called as IP switches.

The number of routers passed by a data packet is called a hop. The time used in figuring the destination of a data unit is called latency. So that's why switches are considered to be the backbone of the gateway at the junction where once network is connected to another, known as core switches, and the sub levels where the transfer or travel of data is done to its origin or destination known as desktop switches.

TYPES OF ETHERNET SWITCHES

Unmanaged Switches

A switch that works for basic connectivity and doesn't need any configuration or installation is called unmanaged switched. Usually, these are used in home networks and they have partial network capacity when compared to managed switches.

Managed Switches

A managed network can be configured and offers scalability and maximum security. Such switches permit monitoring and can be adjusted locally or remotely.

LAN Switches

Switches that are used to connect points on LAN are termed as LAN switches. They are used to reduce network congestion by allocating data packets to its proposed receiver.

PoE Switches

They are used for PoE technology that integrates data and power on same cable. Through these switches, greater flexibility is provided.

Click the QR code to understand the difference between hub, router, and switch

2.3.5 Network Switches vs. Router

Network is created by switches that are further connected by routers. Router picks the most suited way for flow of information in a way that it is received swiftly.

Routers are more sophisticated devices when compared to a switch. Traditional routers are used in multiple area networks, i.e. LANs and WANs. The network traffic flows through routers.
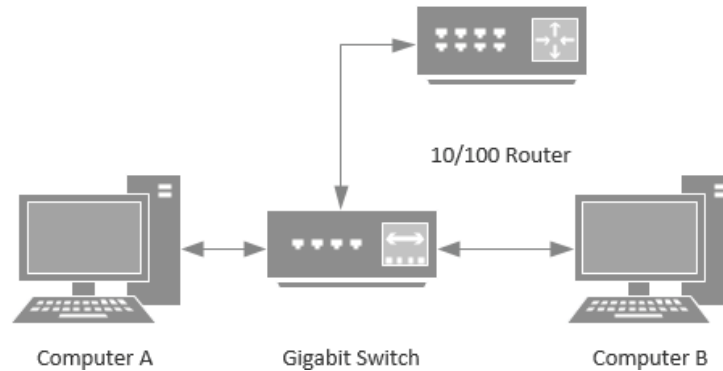
Fig 2.3.8: Network Connectivity through Switch and Router

Switch	Router
It connects multiple networked devices	It connects multiple switches & their respective networks.
It works on the data link layer of the OSI model	It works on the network layer of the OSI model
It is used within a LAN	It can be used in LAN or MAN
It cannot perform Network Address Translation	It can perform Network Address Translation.
The switch takes a long time while making complicated routing decisions	A router can take a routing decision much faster
It provides security to ports only	It provides security measures to protect the complete network
It works in either half or full-duplex transmission mode	It works in the full-duplex transmission mode and per need can be changed to half-duplex mode
It sends information in the form of Frames (for L2 switch) and the form of packets (for L3 switch)	It sends information in the form of data packets
Switches can only work with the wired network	Routers can work with both wired & wireless networks

Tip

- One can check their network's administrator interface, to ensure it's configured for optimum performance.

- Routers can connect with various network architecture like, Ethernet cable, Wi-Fi or WLAN

Exercise

1. Which one of the following network devices stores the IP addresses?

- Router
- Switch
- Both Router and Switch
- None of the above

2. Which one of the following network devices connects two networks?

- Bridge
- Hub
- Repeater
- Gateway

3. Which one of the following network device works in the network layer?

- Router
- Switch
- Both Router and Switch
- None of the above

4. Which one of the following network devices works on the data link layer of an OSI model?

- Hub
- Switch
- Both Hub and Switch
- None of the above

5. Which one of the following network devices connects the devices in a twisted pair?

- Hub
- Switch
- Bridge
- Both Hub and Switch

UNIT 2.4: Equipment Installation Procedures

Unit Objectives ⌖

At the end of this unit, you will be able to:

Execute and demonstrate the procedures for equipment installation

2.4.1 Modem Installation

Modem Installation Process

Step 1: Ensure to check the following items before installing the modem:

| Confirm modem works with internet subscription | ⇨ | Check room's cable output | ⇨ | Identify the place to mount | ⇨ | Arrange the required cables | ⇨ | Read and understand modem's instructions |

Fig 2.4.1: Items to be checked before installing modem

Step 2: Product Overview

It is important to check both front and rear panel.

Front Panel

Fig 2.4.2: Modem front panel (sample)

	ICON	FLASHING	ON
1	POWER	Not applicable — icon does not flash	**Green**: Power is properly connected
2	RECEIVE	Scanning for a downstream (receive) channel connection	**Green**: Non-bonded downstream channel is connected **Blue***: High-speed Internet connection with bonded downstream channels
3	SEND	Scanning for an upstream (send) channel connection	**Green**: Non-bonded upstream channel is connected **Blue***: High-speed Internet connection with bonded upstream channels
4	ONLINE	Scanning for an Internet connection	**Green**: Startup process completed
5	LINK	Transmitting or receiving data on Ethernet port	**Amber**: A device, computer, or hub is connected to the Ethernet (10Base-T) or Fast Ethernet (100Base-T) port **Blue***: High-speed Gigabit Ethernet (1000Base-T) connection from the SB6121 to your PC
6	ENERGY CONSERVATION SWITCH	Powers on and off the cable modem **Note**: The Energy Conservation switch may be an option that is not provided by your service provider.	

Fig 2.4.3: Modem icon table
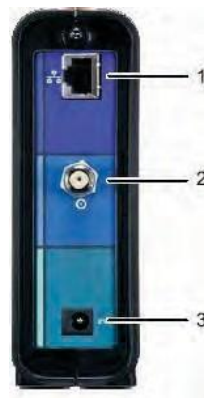
Rear Panel

Fig 2.4.4: Modem rear panel(sample)

ITEM		DESCRIPTION
1	ETHERNET	Ethernet port for connecting an Ethernet-equipped computer, hub, bridge, or switch using an RJ-45 cable
2	CABLE	Coaxial cable connector
3	POWER	+12VDC Power connector

Fig 2.4.5: Modem icon table

Step 3: Connecting the SB6121 Cable Modem
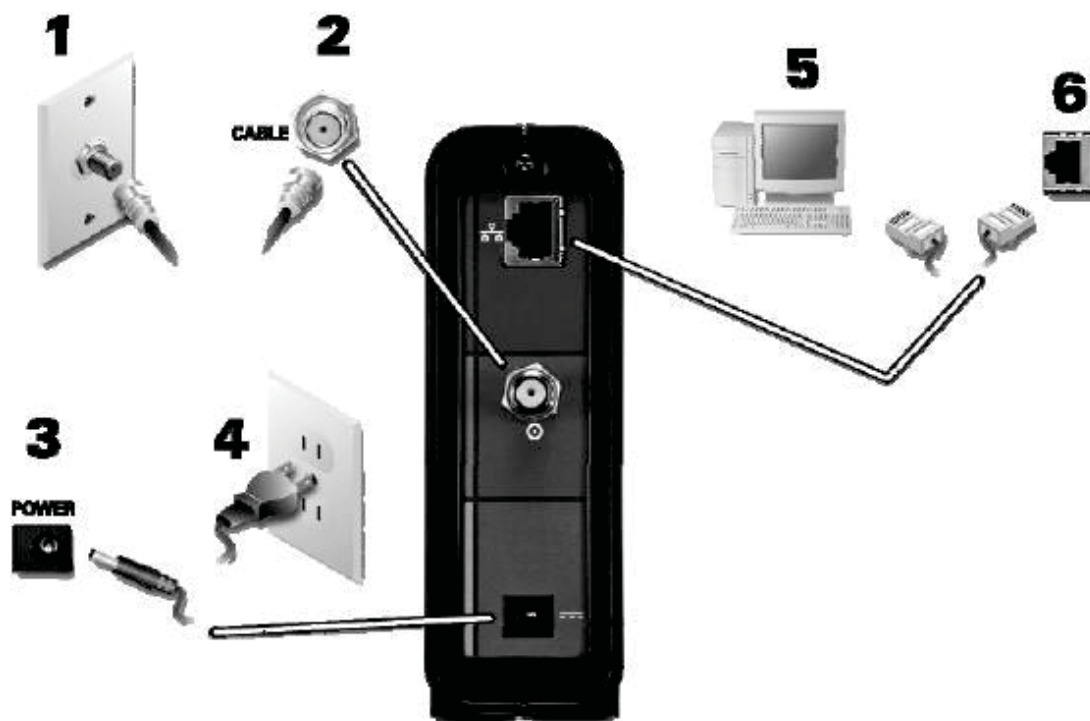
Fig 2.4.6: Ports to connect SB6121 to cable modem

1. Ensure that the coaxial cable is connected to a splitter or a cable outlet
2. Connect the other end of the cable to the input on your modem
3. Tighten the cables properly
4. Plug the end of the power cord to the modem's power port and other end into an electrical wall outlet
5. Connect the end of the Ethernet cable to the Ethernet port and the other end to the modem

Step 4: Wall Mounting the Modem (If required):

- Locate the unit as per the specifications of the local or national codes related to the residential or business cable TV and communications services.
- Follow the standards for the installation of a network interface unit (NIU) or network interface device (NID).
- Do not plug power cord to power outlet while mounting the modem.
- Ensure you have:
  - o Wall-mounting template
  - o Crosshead and flathead screwdriver
  - o Two M3.5 (#6) screws with a flat underside. The maximum diameter of the screw head, required to mount the cable modem, is 9.0 mm

Note: Ensure that the modem is mounted on firm surface.

⚠	Before finalizing the area or wall for mounting, ensure that the area is checked for any water leakage, gas or electrical lines.

A. Mark the holes on the wall, by positioning and securing the wall mounting template.

B. Select the depth and diameter, to drill the holes. The depth of the holes should be at least 1½ inches (3.8 cm).

Note: The installer should determine the depth of the hole by the type of selected hardware.

The following diagram may be referred to, to determine the spacing needed in between the wall surface and underside of the screw head:
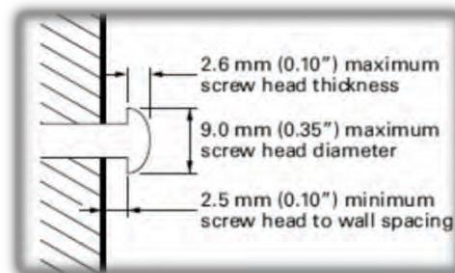
Fig 2.4.7: Spacing while wall mounting the modem

C. Reconnect the coaxial and Ethernet cable, after mounting the cable modem.

D. Connect the power cord into the power outlet on the wall and the +12VDC Power connector on the cable modem.

E. Arrange the cables properly to avoid any safety hazards.

F. Ensure that the cable modem is attached to the wall securely.

Step 5: Wireless instructions for connecting to Internet

- Using a wireless device (computer, tablet, smartphone, or other device), circumnavigate to the list of available Wi-Fi networks. Choose the TDS-named Wi-Fi network (SSID) that matches what is printed on the sticker on modem (D)

- Enter the key on the sticker. There will be need to update wireless devices with this Wi-Fi information in order to connect or can rename Wi-Fi network and change the password.

- In the address bar of an Internet browser, type http://192.168.0.1 and press enter

- On the modem's main screen, enter admin as the username and password as the password

- Click Login and check System Basic Setup Screen

- Update Network Name (SSID) field as required

- Enable WPA2-PSK

- Enter a new WPA key/Wi-Fi Password as desired

- Click Apply
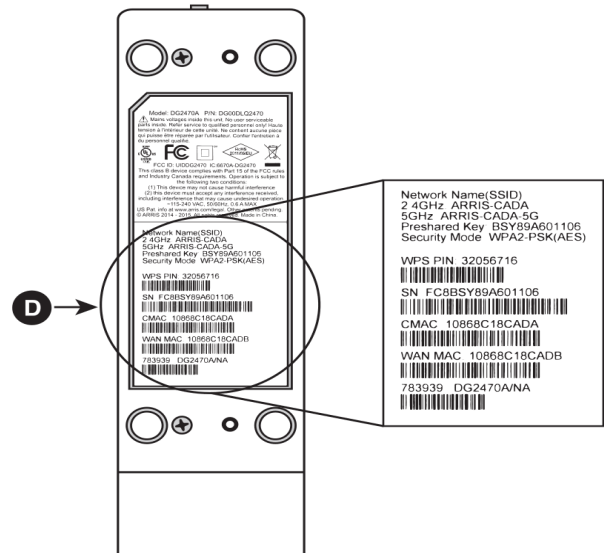
2.4.2 Router Installation

Wireless Router Set Up

Step 1: Check the package of router for the items it is carrying in new pack. Normally any new router packet carries following items:

Wireless router	An AC power adapter (varies by company)	A blue Ethernet cable
Resource CD	User Manual	Warranty and Support Information cards
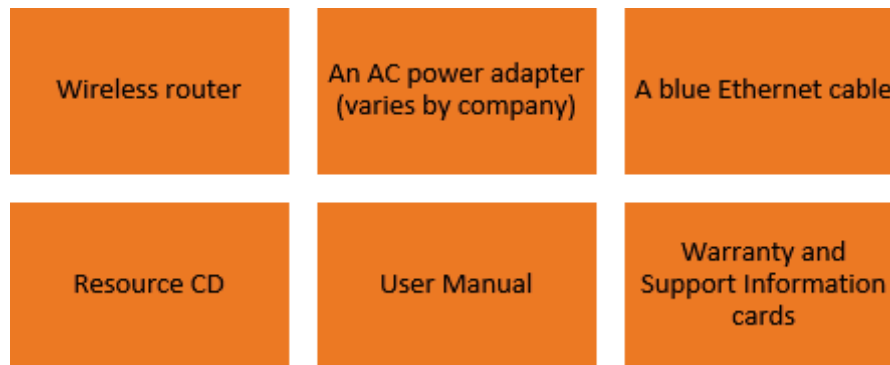
Fig 2.4.8: Router pack components

💡	**Note:** Contact the router dealer in case of missing, incorrect or any damaged part.

Step 2: Information such as serial number, status lights, port connectors and default login is available on a label, which is at the back of the router.

Fig 2.4.9: Port on router rear panel

Step 3: Before setting up a router check for the following:

- Internet service
- Information of Internet Service Provider (ISP) required for configuring the wireless router to access the Internet such as Internet Login Name and Password
- In case of antennas, extend them before installation
- If there are mobile applications provided, run the setup accordingly

(hidden)

Step 4: Use the indicator lights on the front of the wireless router to verify the status of various conditions:
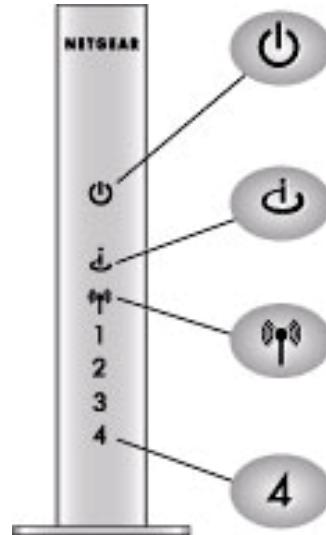
Fig 2.4.10: Icons on front panel of Netgear router

Status Light	Activity	Description
1. Power	On -- Amber	The router integrity test is running.
	On -- Green	Power is on and the router is ready.
	Fast blink -- Green	Software update is in progress.
	Slow blink -- Green	There is a problem with the wireless router
	Off	software.
		Power is not supplied to the router.
2. Internet	On -- Amber	The Ethernet cable is connected but the wireless router has not gotten an Internet address.
	On -- Green	The wireless router has an Internet address.
	Blink -- Green	Data is being communicated with the Internet.
3. Wireless	On	Indicates that the Wireless port is initialized.
4. LAN (Local Area Network) Lights 1-4	On (Green)	The local port is connected to a 100 Mbps device.
	Blink (Green)	Data is being transmitted at 100 Mbps.
	On (Amber)	The local port has detected a link with a 10 Mbps device.
	Blink (Amber)	Data is being transmitted at 10 Mbps.
	Off	No link is detected on this port.

Fig 2.4.11: Light indications on router

Step 5: Check the back of the wireless router

1. Factory default reset button

2. Four local Ethernet ports for connecting the local computers

3. Internet port for connecting to a cable or ADSL modem

4. Power adapter port
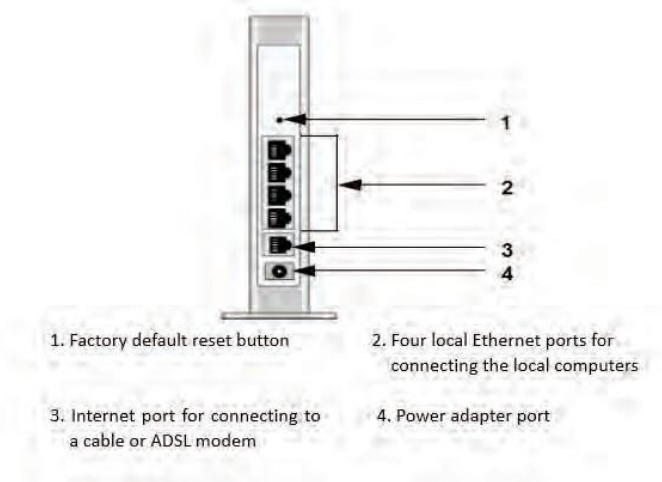
Fig 2.4.12: Rear panel of a router

2.4.3 Networking Switches Installation

Standalone network units are preferred for home and small office setups, while rack mounted switches are used for larger networks. In both setups, Cat5 or Cat6 Ethernet cables are used. Switches connect a single Internet connection to multiple computers. Switches are mostly installed in the similar fashion although their handling of network varies.

Steps for Installation

Step 1: Plug in the power supply.

Step 2: Connect the incoming network cable to the switch, preferably in the first slot. The incoming cable from the modem will be considered in case of home and small office.

Step 3: Connect a Cat5 or Cat6 cable to another slot in the network switch. Attach the other end to a computer that needs to be connected to the network.

Step 4: Repeat this process until all the computers are connected or all slots are filled.

Legend

10 Mbps	– – – –
100 Mbps	———
1000 Mbps	———
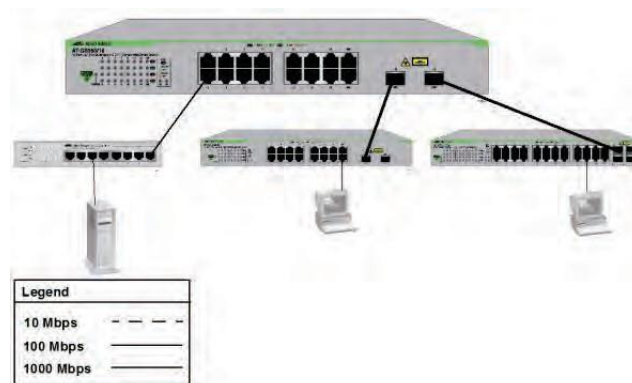
Fig.2.4.13: Switches

Tips

- In a telecommunication network, a switch accepts data from multiple input ports and redirects them to the specific output port. The output port forwards the data toward its intended destination.

- In the OSI communications model, a switch performs the functions of Layer 2 or Data-link layer.

- The time a switch takes to determine the output port, where to forward the incoming data unit, is called its latency.

Exercise

1. Install a modem in the lab and write down the step-by-step process of installation.

_____

_____

_____

_____

2. Install a router in the lab and write down the step-by-step process of installation.

_____

_____

_____

_____

3. Install network switches in the lab and write down the step-by-step process of installation.

_____

_____

_____

_____

UNIT 2.5: UPS and Its Types

Unit Objectives ◎

At the end of this unit, you will be able to:

State the use and types of UPS

2.5.1 UPS

Uninterruptible Power Supply (UPS) is powered by a battery that gets self-activated in events of power cuts. UPS keeps the system running for a while providing time to the user to save data and eventually it shuts down.

Modern-day UPSs come enabled with software that keeps power levels consistent and avoids fluctuations, which can possibly harm the system and equipment.

UPS Types

UPS comes in lots of designs and in different varieties where each has its own diverse characteristics or performance. The most common are as follows:

Standby UPS (Offline UPS)	**Line Interactive UPS**
Double Conversion On-Line	**Delta Conversion On-Line**
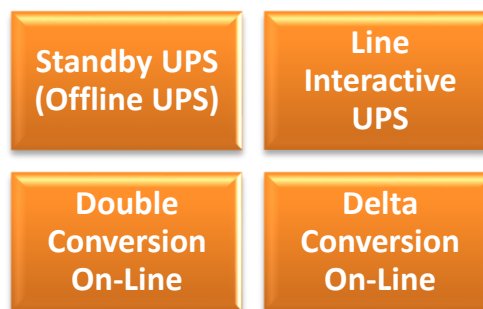
Fig 2.5.1: UPS types

UPS keeps monitoring the power supply and switches to battery power the moment system stops receiving power from the electrical switch. Although there is some time lapse between the time, power is interrupted to the time UPS gets started. Interactive UPS are sometimes referred to as a standby power system. UPS is also categorized into:

Parameters	Offline UPS	Online UPS
Operational Difference	The batteries of offline UPS are charged always. If the power fails, the inverter motorizes the load.	Online UPS takes the incoming AC mains supply and converts it to DC, which feeds the battery and the load through the inverter. If the main supply fails, then the batteries feed the load through the inverter.
Voltage distortion	More fluctuations lead to more offline UPS usage	Voltage alteration does not lessen the performance
Price	They are cheaper	These are costly
When to use	If cost is a major consideration and needs a lower operating temperature	In situations where a square sine output waveform is not acceptable, online UPS are recommended

The following figure shows UPS connectivity:
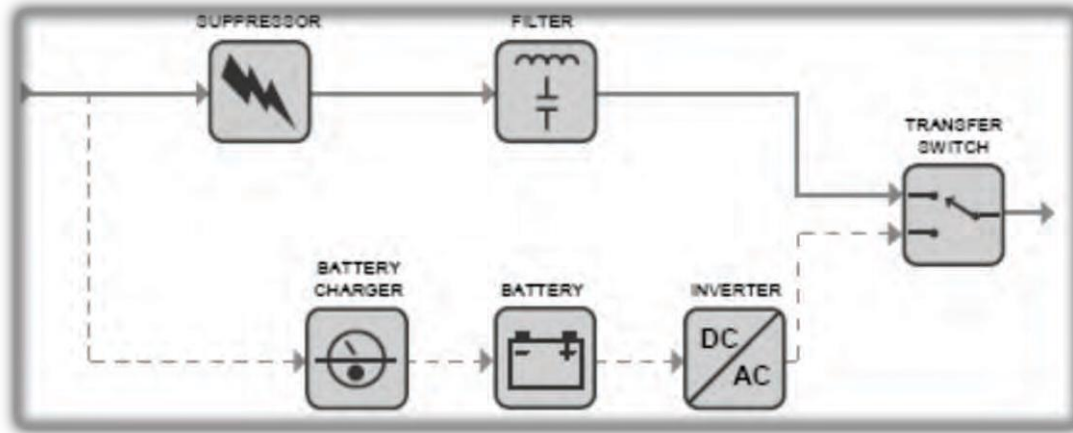
Fig 2.5.2: Illustration showing UPS connectivity
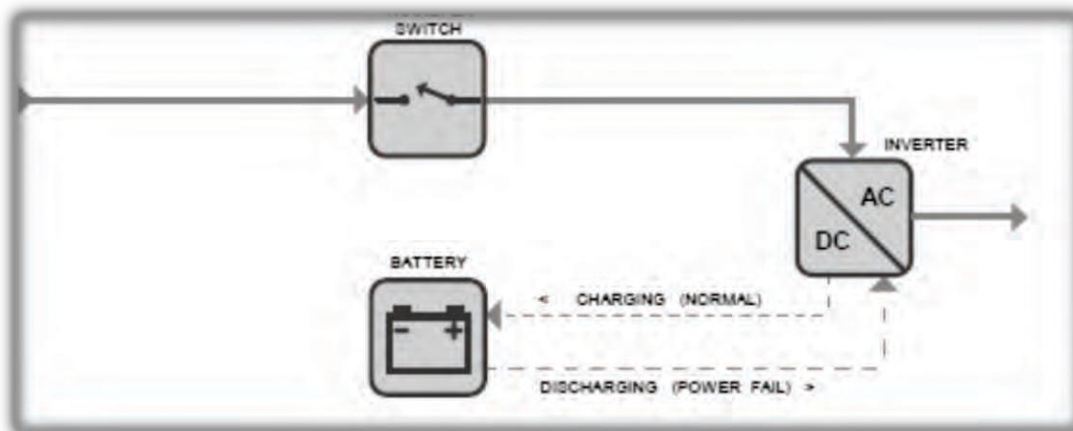
Fig 5.1.2: Online UPS

Tips

- The team responsible for ensuring the working of UPS should ensure regular testing of the equipment. The schedule should include a quarterly check which ensures there are no loose connections or burned insulations.

Exercise

1. What is the purpose of UPS power supply?

_____

_____

_____

_____

_____

_____

2. What are the different types of UPS?

_____

_____

_____

_____

_____

UNIT 2.6: Checking of Voltage, Current and Earthing

Unit Objectives ⊚

At the end of this unit, you will be able to:
Check the voltage, current and earthing

2.6.1 Voltage and Current Checking

A device that is used for measuring voltage, resistance, and current in electronics and electrical equipment is called a multimeter.

Battery voltages, vehicle electrics and electronics, cables continuity, fuses, and home appliances can also be verified using a multimeter as it also tests continuity.

A multimeter is of two types, Analog and Digital:

- Needle style gauge is found in Analog multimeter
- LCD display is seen on Digital multimeter

Fig 5.2.1: Multimeter

A positive connection is confirmed once the **red meter** lead is firmly connected to an amperage port or Voltage/Resistance.

A negative connection is when a **Black meter** lead is connected to any common port.

2.6.2 Earthing

To avoid hazards and mis happenings, proper earthing is essential. The process of sharing the charges with the earth is called "Earthing". It is important for protecting the devices from electric harm.

"Grounding" is a safety process that protects the entire power system from malfunctioning and is largely used to balance the load when the electric system overloads.

Click the QR code to check the use of multimeter and revise electricity basics

It protects the user against electric shock because, in case of any electrical fault, it ensures low resistance, by connecting it to the neutral circuit at the service panel. Ground wiring is always essential.

Any electrical appliance is capable of running without the ground wire; however, this is not an ideal way for connecting an appliance using direct mode. One can't even make a difference if in case the ground wire is broken. Its working or importance comes only in a scenario when there is high voltage. In such a situation if the ground wire isn't working it will cause an electric shock to the user.
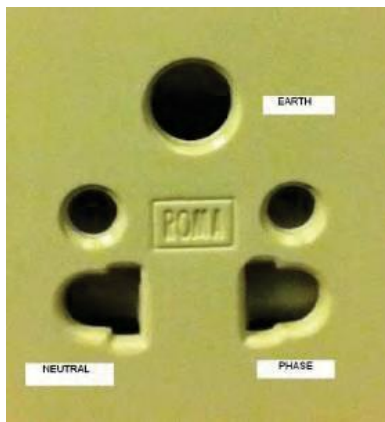
Fig 5.2.2: Electrical switch

Here is an image illustration of an electrical socket or receptacle used in India. The center hole is for earth, left hole is for neutral and the right hole is for phase. Phase is always positive, and this is where the switch is mostly installed.

Earthing Checking Procedure

Multimeter is used to check if there is grounded electrical socket. This is easily available for ~Rs.600 in markets.

Step 1: As shown in the image below, connect the probes and set the knob of the multimeter to 750V AC. Insert the red probe in phase hole and black probe in neutral hole. Here the reading is showing zero because the switch is off.

Fig 5.2.3: Connect multimeter knob

Step 2: Once the switch is turned the voltage across Phase and Neutral can be measured. Here the reading is 240V.

Fig 5.2.4: Turn the multimeter knob

Step 3: Insert the black test probe and red test probe, in earth and in phase respectively, and measure. Here the reading is 243V.

Fig 5.2.5: Connect black test probe to earth outlet

Step 4: Next, put the red probe and black probe in earth and neutral respectively, and measure. The reading should never be more than 2V. Here the reading is 1V.

Fig 5.2.6: Red probe and black in earth and neutral respectively

Step 5: Calculate the voltage difference between Step 3 and Step 2 i.e., 243V - 240V = 3V.

Step 6: Calculate the difference in voltage received in Step 5 and Step 4 i.e., 3V - 1V = 2V. The acceptable value is 1V to 2V.

Please note, the testing is done here to check the existence of earthing circuit. To measure the actual earthing resistance, an Earth Resistance Tester is required.

Tips

- "Earthing" or "grounding" refers to the act of walking barefoot on earth that allows the free electrons transfer from the earth into your body.
- The term "Earthing means a Zero Volt circuit is physically connected to the ground.
- However, "Grounding" the circuit does not mean the circuit physically connected to ground but making the potential of a point in the circuit zero (the currents are algebraically zero) with respect to other point.

Exercise

1. How will you check current and voltage of power supply?

_____

_____

_____

_____

_____

_____

2. Explain steps for checking Earthing.

_____

_____

_____

_____

_____

_____

UNIT 2.7: Checking and testing battery

Unit Objectives 🎯

At the end of this unit, you will be able to:

Check and test the battery

2.7.1 Battery checking and testing

Battery checking and testing are critical to the continued performance of a UPS system. There is automatically built-in functionality to evaluate batteries timely and alert if there is any defect, in most power supplies. Merely testing voltage doesn't provide the correct picture of battery condition.

The best way to assess the correct condition is through external battery testing. For large battery sets, specific block testing can be more dependable. External battery testing should form part of a planned preventive UPS maintenance rule, while it can also be provided as a separate service.

Types of Battery Testing

Impedance Testing	Electro- chemical Testing	Load Bank Testing(Discharge Testing)	Partial Discharge Testing
•Applies AC Current to each battery through probes •Shares an indication of battery life	•It uses probes to measure voltage frequency and signals •It measures sulphation and electrolyte dry-out	•It evaluates which cell is charged and indicates those reaching end of service life •Batteries are treated externally	•Batteries are discharged upto 80% of the capacity •Battreies are reloaded within 8 hours

UPS Battery Monitoring

Dedicated battery monitoring systems also measure UPS battery performance. It is directed monitoring systems incorporate the parameters drawn by the globally recognized IEEE 1491 standard, including:

- String and cell float voltage
- String and cell charge and discharge voltage
- AC ripple voltage
- AC ripple current
- String charge current
- String discharge current
- Ambient and cell temperature
- Cell internal resistance

Tips

- Some maintenance checks required for UPS are:
  - Battery placement in a well-ventilated area
  - Timely check of water level
  - Cleanliness of surface and sides of battery
  - Replacement of dead or damaged batteries
  - Vents around the battery to be dust free and open

Exercise

Fill in the blanks

1. The best way to assess the correct condition is through _____

2. For large battery sets, specific _____ is more dependable

3. Batteries are discharged up to 80% of the capacity in _____ testing

4. UPS battery monitoring uses _____ standard

5. Under _____testing method cell is evaluated to be charged and also indicates those reaching end of service life

Answer the following questions

1. List the different types of battery testing in detail

   _____

   _____

   _____

   _____

   _____

2. List your observations while conducting a type of testing

   _____

   _____

   _____

UNIT 2.8: Installation and repair of UPS

Unit Objectives ⌖

At the end of this unit, you will be able to:

Install a new UPS and repair a defective UPS

2.8.1 UPS Installation

Pre-Installation checks

1. Selecting the Right Company:

An intensive effort needs to be made to identify and select the resource which can assist in the decision-making process. A resource is critical as it also includes the installation of a specialized system.

2. Selecting the UPS:

To decide on the kind of UPS required, one needs to check on the following things-

- The amount of load UPS will protect
- Kind of equipment UPS will protect like, servers, medical equipment, etc.
- Tolerance level of downtime
- Stability of UPS in the long run
- Cost-effectiveness

3. Location to install

Along with UPS, batteries must also be safely lodged, thus floor must support the load. Space evaluation needs to be considered keeping in mind any possible future expansion. The environment of the location must be sufficiently air-conditioned and protected from extreme dust and dampness. On solid floors, a cable trench or UPS plinth will be compulsory to permit power cabling and termination under the UPS and battery.

Installation Procedure

1. Install the battery breaker kit in the bottom of the empty classic battery cabinet
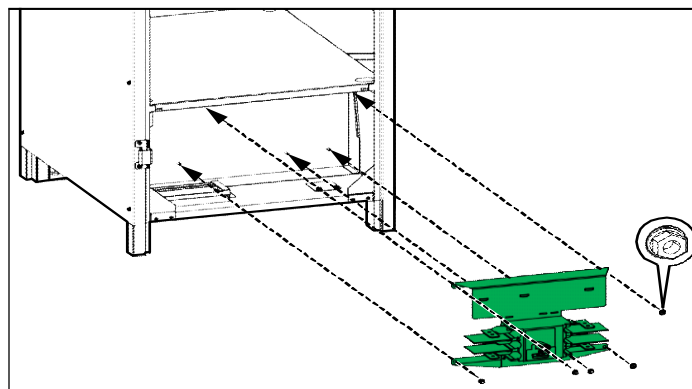
Figure 5.4.1: Front view of Empty battery cabinet

(Pic credit: https://www.productinfo.schneider-electric.com)

2. Remove gland plates for signal and power cables
3. Drill and reinstall gland plates
4. Remove the eight screws holding the battery breaker plate
5. Remove the battery breaker plate
6. Connect the signal cables by installing the sensor to check the temperature
7. Align sensor cables through the top or bottom of the cabinet to UPS dry contact terminal
8. Align signal cables through the top or bottom of the cabinet to the battery beaker
9. After removing the cover, connect signal cables
10. Place the beaker cover on battery beaker
11. Connect power cables from the UPS by connecting PE and DC cables from UPS

Procedure of installing and connecting the batteries

1. Place the batteries on the shelves and connect the batteries
2. Connect the battery cables (Batt+, N, Batt-) in the empty classic battery cabinet to the battery breaker
3. Fix the protection cover over the terminals on the right side of the battery breaker
4. Make a note of the battery configuration on the label

2.8.2 Checks in Defective UPS

Here are common problems which a UPS normally faces along with the process to fix the problems –

UPS is not working properly

1. Check whether UPS batteries are charged to the proper level so that they can operate. Always refer UPS documentation for precise information
2. Inspect the UPS power switch is in the "On" position. To comprehend on the location of the switch, check the UPS documentation
3. Examine UPS software is the updated / latest version
4. Ascertain the power cord is the correct type and study the country in which the server is located. Always refer UPS reference guide
5. Inspect whether the line cord is connected
6. Make sure circuit breakers are in the "On" position, if required, replace the fuse
7. In case the sleep mode of UPS has started, disable it which turns off the configuration mode on the front panel
8. Battery change needs to be done if damage was caused by excessive heat

Low battery warning is getting displayed

1. Immediately plug the UPS into an AC grounded outlet for a minimum of 24 hours to charge the batteries, and then perform testing. If required, replace the batteries
2. Confirm that alarm is set correctly by altering the amount of time given earlier to a low battery warning

Tips

Preventive maintenance is critical for UPS longer life. Thus, focus on –

- Cleaning of dust on or around UPS and batteries
- Rigidity of cable terminations inside the UPS systems, terminal blocks, and breakers
- Strength of DC capacitor banks
- Chilling fan status
- Battery fastening tight check-up
- Distilled water top-up and application of petroleum jelly for batteries
- Documenting Input and output parameter measurements
- Battery backup test

Exercise

Answer the following questions

1. What are the pre-installation checks to be made for UPS installation?

_____

_____

_____

_____

_____

_____

2. What per you are the top 3 maintenance checks for healthy UPS?

_____

_____

_____

_____

_____

_____

UNIT 2.9: Basic Load Calculation

Unit Objectives 🎯

At the end of this unit, you will be able to:

Understand basic load calculations for UPS power supply

2.9.1 Basic Load Calculations

The list of appliances consumption is as follows:

HIGH CONSUMPTION APPLIANCES					
Iron	1000 Watts	100W Light Bulb	100 Watts	Security Cameras	60 Watts
Electric Kettke	2000 Watts	60W Light Bulb	60 Watts	Alarm System	50 Watts
Hairdryer	1500 - 2000 Watts	Cell Phone Charger	10 Watts	PABX	150 Watts
Home Airconditioner	1500 - 2500 Watts	Alarm System	20 Watts	Point of Sale	220 Watts
Swimming pool pump	1500 Watts	Gate Motor	500 Watts	Photo Copier	250 Watts
Power Drill	600 - 1200 Watts	DVD Player	30 Watts	Fax Machine	120 Watts
Toaster	800 Watts	Fish Tank	700 Watts	Hi-Fi System	200-500 Watts
Microwave Oven	600 - 1200 Watts	Personal Compter	300 Watts	Playstation	200 Watts
Stove	1550 - 3000 Watts	Ink Jet Printer	100 Watts	Electric Fence	20- 500 Watts
Tuble Dryer	2500 Watts	Electric Fence	200 Watts	Electric Blanket	50-100 Watts
Clothes Iron	1000 Watts	DVD Player	30 Watts	Water Feature	50 Watts
Vacuum Cleaner	200 - 1200 Watts	Laptop Computer	150 Watts	Slow Cooker	200 Watts
Washing Machine	500 - 1500 Watts	ADSL Model	20 Watts	Fridge/Freezer	500 Watts
Laser Printer	700 Watts	LCD TV	200 - 400 Watts	Ceiling Fan	70 Watts
Hot Plate	1200 Watts	DSTV	20 Watts	Garage Door	600 Watts
Geyser	2500 Watts	Plasma TV	200 - 400 Watts	X-Box	100 Watts
Coffee Maker	800 Watts				
TRY AVOID USAGE DURING LOAD SHEDDING					

Fig 5.5.1: Table listing appliances consumptions

Sizing a UPS/Inverter Solution is a mathematical formula for multiplying CURRENT measured in amps and POWER in volts to get the LOAD rating in Volts-Amps (VA). Another method for load detection is by locating the Watts rating. The following four simple steps to get the load is:

Step 1: Start by listing and placing all the equipment that are protected by inverter or a UPS in one column. For example, computers, alarm, TV, DSTV, lights and fridge.

Step 2: Put the volts and amps of each of these items in column 'b'. This information will be available on nameplates of each item. For example, 120V x 2.0A is written on the plate.

Step 3: Calculate the product of the volts and the amps of each equipment and note the total in a column labelled as "VA". If the rating of the equipment is given in watts, convert the rating to VA by multiplying the figure by 1.43 and note it into your VA column.

Step 4: Add an additional 25% to the total VA load to adapt any future growth. This also helps to avoid any potential overloading of the Inverter/UPS.

Battery Run Example 1:

Inverter/UPS Rating: 1500VA

No. of Batteries: 2

Battery Rating: 12V

Battery Rating: 17Ah

UPS/Inverter Backup me (in Hr. s) = (No. of DC batteries x voltage rating of battery x Ah rating of battery) / VA of Inverter/UPS installed

Answer Equals:

(2 x 12 x 17) / 1500

408 / 1500

0,272 hours or +-15 minute

Example 2:

Computer requires: 2 Amps (current) Mains

Voltage: 230VAC (AC voltage)

Power: 0.6 (typical for computer equipment)

2A x 230V = 460W / 0.6 PF = 766 VA

An 800VA will work fine but keeping future requirements in mind it is advised to 20-25% capacity on top. In given example a 1000VA UPS (1KVA) will be optimum. In case of more than one system or equipment, add all the Amps together and do the calculation as shown.

Fig 5.3.2: Examples

Tips

- Be positive that a particular UPS will be able to handle the total electrical load of the equipment.
- For an UPS with 875Va we can us a maximum load of 640 watts.

Exercise

1. What do you mean by load calculation?

_____

_____

_____

_____

_____

_____

2. List the steps to decide UPS sizing.

_____

_____

_____

_____

_____

_____

UNIT 2.10: UPS and Battery Compatibility

Unit Objectives ⦿

At the end of this unit, you will be able to:

Understand UPS and battery compatibility

2.10.1 UPS and Battery Compatibility

Selecting the optimum size of UPS along with the right kind of batteries is the most important aspect. Batteries come in different sizes and costs. They exhibit a variety of specifications and come with different warranty periods and life expectancies. Choose the one that best suits your needs.

The installation also depends on a number of factors, including:

- Maximum possible load
- Maximum expected load
- Power
- Redundancy level required
- Time used for switching to battery backup
- Time autonomy

Battery Type

The following types of batteries are generally selected for use with a UPS:

Lead Acid/Plate	Lead Acid/Antimony	Lead Acid/Calcium
Lead Acid/Calcium, Maintenance-free Liquid Electrolyte	Lead Acid/Calcium, Maintenance-free Gelled Electrolyte, Sealed	Lead Acid (Special Alloy), Suspended Electrolyte, Maintenance-free, Sealed
	Nickel Cadmium, Pocket Plate Liquid Electrolyte	

Fig. 5.6.1: Batteries, used for UPS

While choosing the most expedient battery one must consider parameters operations, maintenance and cost.

2.10.2 Battery Sizing

The calculations done in this module are by assuming the standard room temperature, 77°F (25°C). Calculations should be altered in case of variations in room temperatures.

Any UPS or battery supplier can be helpful in the following three types of calculations:

Kilowatts per cell

Kilowatts per bank

Ampere per cell
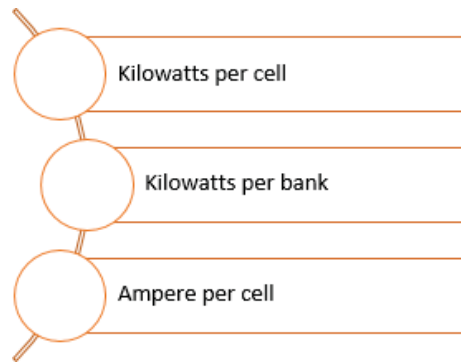
Fig. 5.6.1: Types of calculation for batteries

In general information given for lead acid batteries, designed for short discharge times, typically, 5 - 120 minutes, is in the form of kilowatts per cell. Thus, it is significant to calculate the total kilowatts, required for operating a particular UPS.

Tips

- UPS battery sensor should be recalibrated once or twice a year. The same will need to be replaced once in many years.
- Inverter should be installed in a well-ventilated area as the inverter battery heats up during charging/ operation.
- Specific battery water should be used instead of normal tap water because this can affect the performance due to impurities.

Exercise

1. What do you mean by system compatibility?

_____

_____

_____

_____

_____

_____

2. How will you check UPS and battery compatibility?

_____

_____

_____

_____

_____

_____

UNIT 2.11: Record Keeping and Documentation

Unit Objectives ⊚

At the end of this unit, you will be able to:

1. Understand the importance of record keeping.
2. Understand the importance of documentation.

2.11.1 Importance of Documentation and Record-Keeping

Documentation and record-keeping guarantee accountability and coordination.

Why it is important to document and maintain proper records?

- **Continuity of Care**. While giving best possible service to the customer, following -up is considered to be a major aspect, and records in this step help by providing previous history of the case and brief overview. Records become essential in cases that involve different steps of service to resolve an intricate problem. Updated and factually correct records come in handy in times when the manager or person in charge is not available. To ensure coordinated service between the client and service provider, maintaining and updating the records and documents in timely manner will be prove to be fruitful.

- **Accountability.** The service provider should be able to produce the requested record or relevant information to the client as and when necessary.

- **Service Improvement.** It has been observed that employees of a company that stores its data in systematic manner are more informative and updated than the one which does not focus on these crucial features. Having a substantial set of data helps the analytical teams to read, plan and incorporate new policies, to further improve customer experience.

We all should follow proper record-keeping templates as per the organization's standard and fill it carefully.

Here is sample repair/replacement form for your understanding:

Company / Address of Beam Reseller		CONTACT DETAILS	
Company Name:		Contact Name:	
Address:		Position:	
		Telephone:	
City / State:		Fax:	
Postcode:	Country:	Email:	

Company / Address of End User (Installation)		CONTACT DETAILS (if available)	
Company / Name:		Contact Name:	
Address:		Position:	
		Telephone:	
City / State:		Fax:	
Postcode:	Country:	Email:	

Return Address of Repaired / Replaced Product

☐ Same as "Company / Address of Beam Reseller" above

☐ Same as "Company / Address of End User (Installation)" above

OR:

Company / Name:		Contact Name:	
Address:		Position:	
		Telephone:	
City / State:		Fax:	
Postcode:	Country:	Email:	

Returned for Repair (Out of Warranty)*: ☐ PO#_____

*Note: Repair work can only be performed when Beam receives a Purchase Order # from your company.

Fig 2.11.1: Sample of a repair/replacement form

2.11.2 Installation Report

Why Reporting is Important?

After the installation of software, it is very important to report to your supervisor so that he can understand:

- What was the local need?
- How was it determined?
- Who was the customer?
- What was your role?
- How was the action taken for repair?
- Do you have any customer quotes?
- Was the process followed by you was right?

With Reporting

- He can check your accountability
- He can monitor your progress in handling the customer
- He can evaluate your performance in handling the customer
- He can suggest improvements, if any

Installation report should be filled as per the following format

Every company has their own format of reporting and a technician should fill it accordingly. For your information a general template is as follows:

Broadband Installation Report	
Customer Name:	**Customer Phone:**
Customer Address:	
Contact name:	**Contact Position:**
Customer P.O. No.:	**Invoice Number:**
Product No:	**Product Description:**
COMPLAINT INFORMATION	
Installation Date:	**Installation done by:**
Installation Details	
Installation check list: o Modem o Router o Switch o Connector o Cable	

Fig 2.11.2: Sample of a reporting form

2.11.3 Feedback Form

Take feedback from the customer. Here is the template for customer satisfaction level to the product Installation:

	Very Satisfied	Satisfied	Unsatisfied	Very Unsatisfied	Not sure
Quality of services provided					
Professionalism and courtesy of the technician					
Timeliness of services provided					
Awareness of this service					

Fig 2.11.3: Sample of a feedback form

Test Your Reporting Skill

Broker name/Logo	Customer Complaint Report

However, in case the complaint is not get resolved within two working days, the technician should immediately report the same to his reporting manager.

Customer name:		Name of the member or technician working on the complaint	
Account No:		Name of the broker (which may remain same as above)	

Reason for Complaint:

Details of complaint:

Source of complaint (phone/email/letter/in person, etc.):

Actions already taken to resolve the complaint:

- One can record details here (although, optional) if the complaint is resolved on the next business day. Fill the 'Complaints resolved by the end of the business day' log and update the same on customer's file.
- Once the issue gets resolved, pass the sheet containing the steps taken to resolve a particular issue along with the supporting documents to your manager.

Signature of Staff:		Date:		Print Name:	
Complaints/ Compliance Manager Signature:		Date:		Print Name:	

Complaints Manager/Compliance Use Only

Actions taken/Final Outcome: (please give a summary of actions/correspondence)

Signature	Date

Fig 2.11.4: Sample of a complaint form

Along with this report provide all supporting documents to the complaint manager.

Tips

- To keep everyone on the same page, documentation of each step should be on a system, whether it is a simple record of one's target user base
- Manuals that are designated for the end users are referred to as user's documentation. These are designed to assist users to use any product/service
- Never assume: One must treat every customer as an individual and should ensure their issues are treated as unique problems. Give importance and treat every customer politely

Exercise

1. Prepare a Customer Complaint Report.

_____

_____

_____

_____

_____

_____

2. What do you mean by record keeping?

_____

_____

_____

_____

_____

_____

3. Configure Equipment and Establish Broadband Connectivity

TEL/N0112

Key Learning Outcomes

At the end of this unit, you will be able to:

1. Understand the network topologies.
2. Understand the basic command related to networking.
3. Understand the connectivity of CPE and End User devices.
4. Understand the Configuration of CPE and End User devices.
5. Understand the process of configuration testing.
6. Understand technical data.
7. Execute speed test and its analysis.

UNIT 3.1: Network Topologies

Unit Objectives ⊚

At the end of this unit, you will be able to:

1. Understand the network topologies

3.1.1 Topology

Schematic description of the planning of a network is referred to as topology when discussing communication networks.

Network geometry is defined in following two ways:

- Physical topology
- Logical (or signal) topology

Bus network topology: This topology has each workstation connected through the main cable called bus. Or simply put, all devices are connected sequentially to every other in the network.

Star network topology: has the central device, the server, connected to all other computers in a network. In this type, each computer is indirectly connected to each other through the server.
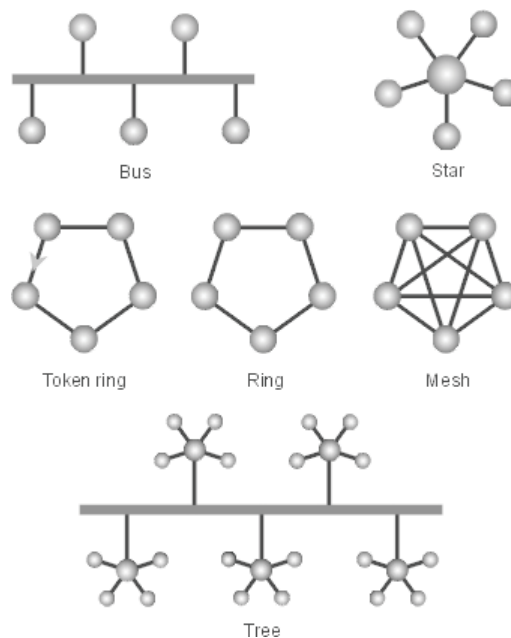
Fig 3.1.1: Types of topologies

Ring topology: has all computers connected in a closed loop configuration.

Signal travels in a singular direction if a **Token Ring** protocol is used either on star or on ring topology.

The **mesh network topology** consists of two types: full mesh and partial mesh. When each system is interconnected directly it's called as full mesh topology. In case where some systems are connected to each other while the others are only connected to those, which exchange data in abidance, is referred to as partial mesh topology.

When two or more-star networks are connected together it's referred to as **tree network topology.**

Logical (or signal) topology: is the path used by signals to follow from node to node. In most of the cases logical topology and physical topology is the same.

3.1.2 Broadband Network Elements

Network Gateway

The network point which is like an entrance to another network is called as gateway.

Host nodes are referred to as either of the ones which a specific user uses and also the computer that serves pages to users. The computers that are responsible for controlling traffic, whether it's within the company or at service provider end are denoted as gateway nodes.

IP address

Internet Protocol is the full form of IP addresses. Any computer is identified by an IP address on TCP/IP network.

Any IP address is 32 numeric numbers, which are written as set of four numbers and are separated by periods. The range of these numbers varies from zero to 255. For example, 1.150.12.240 can be an IP address.

Unique and random IP addresses can be assigned on an isolated network. In case of a private network, one is required to use only registered IP addresseses, which ensures there is no duplicity.

An IP address can be **static or dynamic**. In case of static IP address, the address never changes unlike in case of a dynamic IP address which is a temporary address that gets assigned to a system every time it's connected to Internet. There are two standards for IP addresses. They are IPv4 and IPv6, where "v" stands for version.

Most of the systems are configured on IPv4 address system. Many of them are now moving to new IPv6 address system. The differences between the two versions are as follows:

- IPv4 uses 32 binary bits. This type of address is written in a format which is separated by dots and is set of four numbers. For example: 216.27.61.137. Each number is the decimal representation for an eight-digit binary number, also called an octet. The decimal representation is called base-10 and the eight-digit binary representation is called base-2.

- IPv6 uses 128 binary bits. The address is represented by eight groups of hexadecimal numbers separated by colons. For example2001: cdba:0000:0000:0000:0000:3257:9652. The hexadecimal representation is also called base-16. Groups of numbers with all zeros, are mostly removed in order to save space, leaving a colon separating the groups, to mark the gap. For example, the previous example is written as 2001: cdba::3257:9652.

Subnet Mask

Helps in routing traffic within a subnet through a series of numbers. On an arrival of any packet at any organization's gateway, it routes it to its desired destination subnet number. A router identifies these number series to understand the routing. For an instance, in a binary mask,

- a "1" over a number denotes "Look at the number underneath;"
- a "0" denotes "Don't look."

Using such a mask prevents the router from handling the whole32 bit address. The router looks only at the bits selected by the mask.

Using the previous example, the combination of the network number and subnet number acquires 24 bits or three of the quads. The appropriate subnet mask for the packet would be: 255.255.255.0. It may also be represented as a string of all 1's for the first three quads and 0's for the host number. Subnet masking allows the routers to transfer the packets more quickly.

Ethernet Address

In computers or printers, a number which is assigned by a manufacturer to its hardware is referred to as an Ethernet or wireless address. To ensure the uniqueness of Ethernet and Wireless number all the manufactures work together under a code.

An Ethernet address, also known as wireless hardware address, is a 6-byte hexadecimal number. For example, 080007A9B2FC. Each byte is represented as two hexadecimal digits that makes the address of twelve hexadecimal digits, where each of these digits have a number between 0 to9 and a letter from A to F (can be either upper / lowercase).

Sometimes a '0x' is written before the value to indicate that the value should be interpreted as a hexadecimal one. But, the '0x' should not be taken as part of the value.

It is commonly seen that these are separated by six pairs of hexadecimal digits with colons or dashes. The letters A-F, are considered as hexadecimal digits. For example like: 08:00:07: A9:B2:FC or 00-00-94-ba-0e-cc. Leading zeros can be dropped; and the address is represented as 8:0:7:A9:B2:FC or 0:0:94:ba:e:cc.

Note: One should not confuse an Ethernet addresses with an IPv4 address.

MAC Address

It doesn't matter if one works in a wired network or wireless environment because it anyways takes software and hardware together for data transfer. For the right data to reach a specific system requires the addresses. It is important for the hardware to have its own address because of NIC; interface card. NIC is a circuit card through your computer gets connected to a network.

NIC converts date into electrical signals.

Every NIC has a hardware address called MAC; Media Access Control, which is related to hardware, as IP addresses are linked to TCP/IP.
Network adapter gets its unique MAC address during the time of manufacturing, and the IP address gets translated to MAC address by ARP (Address Resolution Protocol).

MAC address at times is also stated as the burned-in address (BIA). For example, 00:0a:95:9d:68:16 is a MAC address for an Ethernet NIC.

Dell, Belkin, Nortel and Cisco are some common manufacturers of NIC. These manufacturers put a unique number sequence, known as **Organizationally Unique Identifier** (OUI), in front of the MAC address identifying them as the manufacturer.

Example are as follows:

- Dell: 00-14-22
- Nortel: 00-04-DC
- Cisco: 00-40-96
- Belkin: 00-30-BD

Larger manufacturers may have more than one set of OUIs.

Networks and MAC addresses

While diagnosing network issue MAC addresses are considered to be reliable because of their fixed addressed.

Wireless Routers and MAC Filtering

MAC filtering is a measure of security implemented on wireless networks to prevent unauthorized access by intruders or hackers. In such set up router are configured in a manner that they only accept traffic from specified addresses. This way, only approved MAC addresses computers communicate through the network.

Tips

- MAC filtering is a measure of security implemented on wireless networks to prevent unauthorized access by intruders or hackers.

Exercise

Answer the following questions:

1. What are the important topologies for networks?

_____

_____

_____

_____

_____

_____

2. What is a mesh network?

_____

_____

_____

_____

_____

_____

3. What do you mean MAC Address?

_____

_____

_____

_____

_____

_____

Exercise

Multiple Choice Questions

1. A term that refers to the way in which the nodes of a network are linked together.
   a) Network
   b) Topology
   c) Connection
   d) Interconnectivity

2. A network comprising multiple topologies
   a) Complex
   b) Hybrid
   c) Bus
   d) Star

3. What is the maximum number of IP addresses that can be assigned to hosts on a local subnet that uses the 255.255.255.224 subnet mask?
   a) 14
   b) 15
   c) 16
   d) 30

4. If a host on a network has the address 172.16.45.14/30, what is the subnetwork this host belongs to?
   a) 172.16.45.0
   b) 172.16.45.4
   c) 172.16.45.8
   d) 172.16.45.12

UNIT 3.2: Basic Commands

Unit Objectives

At the end of this unit, you will be able to:

Understand the basic commands related to networking

3.2.1 IP CONFIG Command List

IPCONFIG Command

ipconfig

It is used to check the current IP and TCP setting. This even allows you to check the default gateway along with finding the subnet mask.

```
C:\Windows\system32\cmd.exe

Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.   All rights reserved.

C:\Users\LEADERZWALK>ipconfig

Windows IP Configuration

PPP adapter TATA PHOTON+:

   Connection-specific DNS Suffix  . :
   IPv4 Address. . . . . . . . . . . : 59.161.177.173
   Subnet Mask . . . . . . . . . . . : 255.255.255.255
   Default Gateway . . . . . . . . . : 0.0.0.0

Wireless LAN adapter Wireless Network Connection 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Local Area Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

Fig 3.2.1: ipconfig command

ipconfig /all

This command lets a user check all information related to IP, DNS server and MAC Address.

One can even find the IP address of the gateway with this command.

Fig 3.2.2: Finding IP address of gateway through ipconfig command

ipconfig /release

This command helps in obtaining a new IP Address from DHCP server and releasing the current IP information.

ipconfig /renew

In case the system is set to obtain a new IP address on it won this command helps in renewing the same.

ipconfig /displaydns

Used for viewing the existing DNS Resolver Cache Logs.

ipconfig /flushdns

Flushes/clears current DNS Resolver Cache Logs.

ipconfig /registerdns

This is used for refreshing the DNS settings. This comes handy while troubleshooting connection problems with ISP such as failing to acquire a dynamic IP address or failed attempt while connecting to the ISP DNS server.

3.2.2 PING Command List

Ping

This is a primary TCP/IP command and is used to troubleshoot connectivity, name resolution and reachability. It verifies IP-level connectivity of a computer with another TCP/IP computer by sending Internet Control Message Protocol (ICMP) Echo request messages.

PING Command

In all of these examples "**xxx.xxx.xxx.xxx**" is an example of a Domain Name or an IP Address.

Ping xxx.xxx.xxx.xxx

To Ping an IP Address, type Ping followed by the IP address in the command prompt. "**xxx.xxx.xxx.xxx**" is representing the address here.

Ping <<site>>.com (web address)

To ping a website, the domain name of the website is to be typed following Ping. In case one is aware of websites IP Address, he/she may ping that too.

Ping Command Switches

The switches may be used together.

Continuous Ping (Ping xxx.xxx.xx.xx –t)

This will continue to run the ping process till Ctrl + C is used to stop. This is useful while troubleshooting intermittent connections.

Number of Pings (Ping xxx.xxx.xx.xx -n 10)

The switch "n" is used to set the number of pings. By default, the ping command transmits 4 packets of 32 bytes each.

Size of Packet (Ping xxx.xxx.xx.xx -l 1500)

By default, 32 bytes is used for sending packets. One can set the size up to the maximum of 65500 bytes. This comes handy while running a stress test on any local network.

Time Out (Ping xxx.xxx.xx.xx -w 5000)

The time given, is in milliseconds. Default timeout is 4,000 milliseconds, amounting to 4 seconds.

Resolving Host name Address (Ping -a xxx.xxx.xx.xx)

This is used for finding the model number of a router. Host of an IP address can be resolved by using this command.

Tips

- ipconfig is used to search for the IP Address of the device, Default Gateway and Subnet Mask.

Exercise

Fill in the blanks:

1. Ipconfig command stands for_____.

2. Ipconfig displays all current _____ and refreshes _____ settings.

3. _____ command flushes the DNS cache.

4. The command which refreshes DHCP registers is _____

5. _____ command display the contents of DNS cache

6. _____ command is useful while troubleshooting intermittent connections.

7. The switch _____ is used to set the number of pings.

8. _____ is a primary TCP/IP command and is used to troubleshoot connectivity, name resolution and reachability.

9. To ping a website _____ command is used.

10. _____ will continue to run the ping process till Ctrl + C is used to stop.

UNIT 3.3: Connectivity of CPE and End User Devices

Unit Objectives ⊚

At the end of this unit, you will be able to:

1. Understand the connectivity of CPE and End-User Devices
2. Understand the configuration of CPE and End-User Devices

3.3.1 Broadband Connectivity

A telecommunications hardware that is positioned at customer's home or at the business of a customer is referred to as CPE device. Some examples of such equipment are set-top boxes which are used for cable, digital subscriber line or broadband routers, VoIP base stations, telephone handsets, etc.

In most cases, such devices need to support Wi-Fi 6 or 10G connections to mobile phones, laptops, tablets, game consoles, and smart home devices. Internet of Things (IoT) devices are challenging as they can't connect to main CPE.

Following illustrations explains the broadband connectivity from the main infrastructure to end users' devices. Which can be a computer, telephone, television sets, and digital cameras. Packet-based infrastructure is allowed by the gateway equipment.
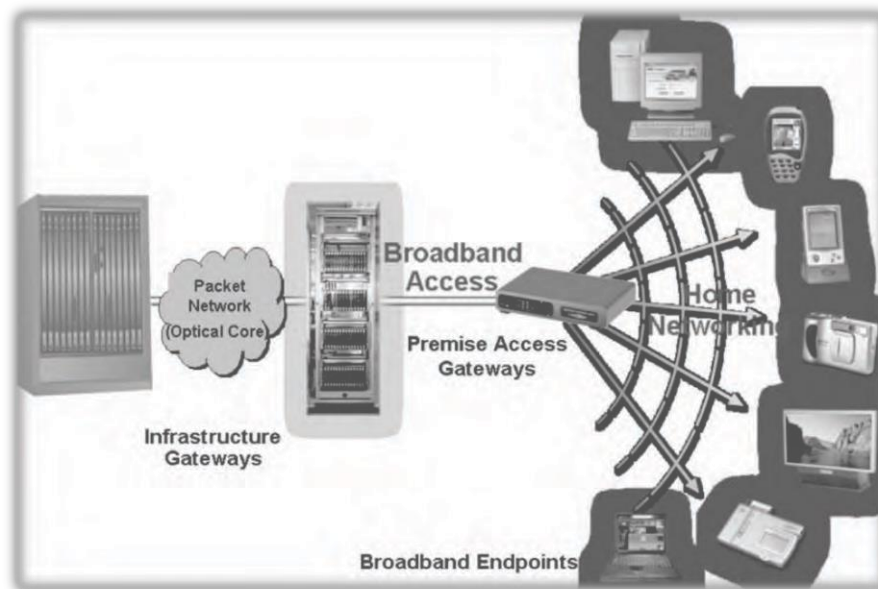
Fig 3.3.1: Broadband Connectivity

3.3.2 Connectivity

Once the installation of CPE is completed one can connect either a computer or other devices to the Internet.

Type www.google.com in the address bar.

Access a web browser.

Fig 3.3.2: Steps for Internet browsing

If the desired website opens, it means the Internet is connected. If not, recheck the website address. If the problem persists, it's advised to check the cable connection and re -configure the modem/router.

3.3.3 Configuring TCP/IP for Windows 11

| Click **Start -> Control Panel** | Click **Network and Internet** | For Wi-Fi, select Wi-Fi-> Manage known networks **and choose network for which the settings needs to be altered** | **For Ethernet, selct** Ethernet, then select netwrok to connect |

| Next to **IP assignment**, select **Edit** | **Select Automatic (DHCP) or Manual under Edit network IP settings or Edit IP settings** | To specify IPv4 / IPv6 settings manually.Under **Edit network IP settings** or **Edit IP settings**, choose **Manual**, then turn on **IPv4/IPv6** | To specify an IP address, in the **IP address, Subnet mask**, and **Gateway** boxes, type the IP address settings |

| To specify a DNS server address, in the **Preferred DNS** and **Alternate DNS** boxes, type the addresses of the primary and secondary DNS servers | To specify if you want to use an encrypted (DNS over HTTPS) or unencrypted connection to the DNS server you specify, for Preferred DNS encryption and Alternate DNS encryption, choose the setting you want | **Select** Save |

Fig 3.3.3: Steps to configure TCP/IP

Tips

- Take a backup of the router setting in case you face any issues while setting up the new configuration.

Exercise

1. Demonstrate configuration of ICP/TP in Windows 11 and write the steps.

_____

_____

_____

_____

_____

_____

2. Demonstrate configuration of ICP/TP in MAC and write the steps.

_____

_____

_____

_____

_____

3. Explain CPE.

_____

_____

_____

_____

_____

_____

UNIT 3.4: Configuration Testing

Unit Objectives ⊚

At the end of this unit, you will be able to:

Understand configuration testing.

3.4.1 Verifying IP address in Windows 11 for Wi-Fi

Once TCP/IP configuration is complete in windows 11, go for verifying the IP Address

| Click **Start -> Settings-> Network & internet** > **Wi-Fi** and then select the Wi-Fi network | → | Under **Properties**, look for your IP address listed next to **IPv4 address**. |
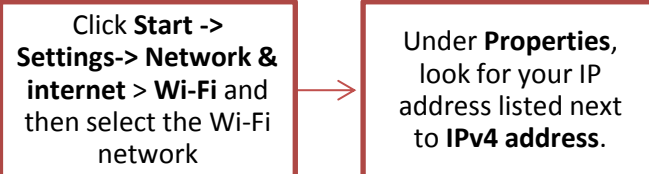
Fig 3.4.1: Steps to test TCP/IP configuration Windows 11

3.4.2 Verifying IP address in Windows 11 for Ethernet

Once TCP/IP configuration is complete in windows vista, go to Verifying the IP Address.

| Click **Start -> Settings-> Network & internet** > **Ethernet** and then select the Wi-Fi network | → | Under **Properties**, look for your IP address listed next to **IPv4 address**. |
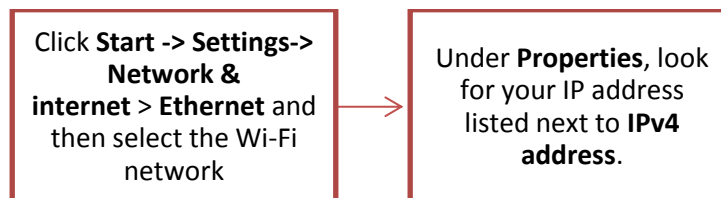
Fig 3.4.2: Steps to test TCP/IP

Tips 🔍

If your Internet suddenly starts running slow, you should to go www.speedtest.net.in to check the speed at client's site.

Exercise

1. What do you mean by configuration testing?

_____

_____

_____

_____

_____

_____

2. How will you do configuration testing?

_____

_____

_____

_____

_____

_____

3. Why configuration testing is important?

_____

_____

_____

_____

_____

_____

UNIT 3.5: Comprehension and Interpretation of Technical Data

Unit Objectives ◎

At the end of this unit, you will be able to:
Comprehend and interpret technical data

3.5.1 Interpretation of Technical Data

It is very important for a broadband technician to know how to interpret the technical data. He should be aware of technical data and its interpretation.

Let's learn to read and understand IP Configuration and network problems.

Configuration of Internet protocol is the backbone of Internet service and networking. Various settings on the system can be checked with IP Config utilities. In such a case, one should start from finding a network issue.

To start with, open command prompt and type "ipconfig /all". Only type the command itself into a command window. Start - Run - "ipconfig /all..." should not be typed.

Export the data to text file for easy access, type the following commands one by one:
- "ipconfig /all >c:\ipconfig.txt" (less the "")
- "notepad c:\ipconfig.txt" (less the ""), for immediate examination.
- Or, copy file to another computer by typing "c: \ipconfig.txt", for comparative examination.

The following image shows an example of IPConfig ("ipconfig /all") from a pair of computers on a LAN:

```
Windows IP Configuration
Host Name . . . . . . . . . . . . : Search1
Primary Dns Suffix . . . . . . . :Node
Type . . . . . . . . . . . . . : Broadcast IP
Routing Enabled. . . . . . . . : No
WINS Proxy Enabled. . . . . . . . : No
DNS Suffix Search List. . . . . : search.net

Ethernet adapter Local Area
connection:
Connection-specific DNS Suffix. :
```

```
Description . . . . . . . . . . . : 3Com Ether Link XL 10/100 PCI For
Complete PC Management NIC (3C905C-TX)
Physical Address. . . . . . . . . : 00-04-76-D7-C5-6A
Dhcp Enabled. . . . . . . . . . . : Yes
Auto configuration Enabled . . . . : Yes
IP Address . . . . . . . . . . . . : 92.168.1.50
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.1.1
DHCP Server . . . . . . . . . . . : 192.168.1.1
DNS Servers . . . . . . . . . . . : 192.168.1.11
192.168.1.33
Lease Obtained . . . . . . . . . . : Wednesday, April 16, 20 15 11:19:12
Lease Expires . . . . . . . . . . : Wednesday, April 23, 20 15 11:19:12
```

```
             Windows IP Configuration
             Host Name . . . . . . . . . . . . : PChuck2
             Primary Dns Suffix . . . . . . . :
             Node Type . . . . . . . . . . . . : Hybrid IP
             Routing Enabled. . . . . . . . : No
             WINS Proxy Enabled. . . . . . . . : No
             DNS Suffix Search List. . . . . . : search.net
```

```
Ethernet adapter Local Area
connection:
Connection-specific DNS Suffix:
Description . . . . . . . . . . . : 3Com Ether Link XL 10/100 PCI For
Complete PC Management NIC (3C905C-TX)
Physical Address. . . . . . . . . : 00-04-76-D7-76-BC
Dhcp Enabled. . . . . . . . . . . : Yes
Auto configuration Enabled . . . . : Yes
IP Address . . . . . . . . . . . . : 92.168.1.51
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.1.1
DHCP Server . . . . . . . . . . . : 192.168.1.1
DNS Servers . . . . . . . . . . . : 192.168.1.11
192.168.1.33
Primary WINS Server . . . . . . . : 192.168.1.1
Lease Obtained . . . . . . . . . . : Wednesday, April 16, 2015 11:53:45
Lease Expires . . . . . . . . . . : Wednesday, April 23, 2015 11:53:45
```

What does this tell us?

```
Host Name . . . . . . . . . . . . : Search1
```

This is the name of the computer, as seen by Internet Protocol.

```
Primary           Dns          Suffix  .     ..    .     .      :
DNS Suffix Search List. . . . . . : search.net
```

Tips

- Broadband in telecommunication is a method which allows a wide bandwidth data transmission having multiple signals and traffic types. It can be transmitted through coaxial cable, optical fibre, radio or twisted pair.

Exercise

1. What do you mean by technical data?

_____

_____

_____

_____

_____

_____

2. How do you interpret technical data?

_____

_____

_____

_____

_____

_____

3. What does DNS server number indicates?

_____

_____

_____

_____

_____

_____

UNIT 3.6: Executing speed test and analyze

Unit Objectives ⊚

At the end of this unit, you will be able to:

Understand how to run, read and communicate speed tests

3.6.1 Speed Test measures

To measure Internet connection's ultimate speed, like, speed of uploading and downloading information by accessing nearby test servers, speed tests are required.

The test impersonates online activity of a user in a controlled setting by downloading sample files and recording speeds. These tests are helpful for isolating ISP's performance as a variable in the quality of the connection. Speed tests won't project absolute Internet speed, but they will give a nearby estimate. Results may vary depending on location and the time of day.

Speed test results match what's stated in ISP plan given to the user.

Certain terminologies

- **Download speed** – how fast data can be fetched from the server to user's location, measured in megabits per second (Mbps)
- **Upload speed** – how fast data is sent to others, measured in megabits per second (Mbps)
- **Megabits per second (Mbps)** – a unit of measure for bandwidth
- **Latency** – the time data took to travel to its destination and returned back to user
- **Ping** – a tool to measure latency between user's system and remote destination

How to run a speed test

Switch off any slow applications (Photoshop, Spotify, etc.) before running speed test as it will interfere with measurement. Search Google for "Internet speed tests," there are number of options available. Speedtest.net by Ookla is effective.

By clicking on "Begin" option at home page, system will attempt to download a file from the server. As the download completes, download speed will be measured. Once the download process completes, system will attempt to upload a file to the test server, therefore calculating the upload speed.

Download speed here is expressed in Mbps (Megabits per second. 1 Mbps is the equivalent of 1,000 Kbps (Kilobits per second), and 1,000 Mbps is the equivalent of 1 Gbps (Gigabits per second).

Click the QR code to know how to perform speed test

Interpret the Results

Both upload and download speed should have a score almost close to ISP's service plan. In most of the cases, connections are planned to download faster than they upload. The majority of online activity—like loading web pages or streaming music—consists of downloads. Upload speed is necessary when there is a need to send big files via email or for video conferencing.

In a gigabit connection, hardware like an ethernet cable, solid-state drive, and CPU needs to be checked to analyze the challenges for an effective Internet speed. Most of the services, display "ping" results, which are measured in milliseconds, accompanied by download/upload speed. This refers to the latency of the connection.

Troubleshoot a faulty speed test

- Check for the devices connected to network which may interfere
- Ensure healthy condition of hardware equipment like computer, router, modem, and cables
- In case of cable, check each end of the coaxial connection for any looseness or damage
- Disconnect attached equipment for 30 seconds
- If Wi-Fi is used, switch it off and put your system on modem directly

3.6.2 Communication with client

- It is very critical to communicate the speed results and analysis with the client. However, prior to that, it is equally important to listen to the problem of the client by giving utmost attention while client is speaking or asking questions. This will help to understand their thought process and expectations.

- Treat the client with respect. Client can be aggravated owing to the challenges of connection, staying calm and composed in that situation will resolve half of the matter. Words like "Sorry" and "Thanks for your patience" are considered to do magic, so try them often.

- Circulate all important correspondence, updates, and action plans via email to client to keep them updated. Keeping them informed will assure client that the action is happening and wins their confidence.

- Make yourself available over the phone and always respond to emails within the specific timelines and keep a close watch on timely closures. Following such practices will improve your reputation and you will be respected by everyone.

- Keep client updated on the reasons for lower speed and what could be the possible scenarios of it. Educate client by sharing some useful tips on maintaining the connection effectively.

Exercise

1. Explain the process of running a speed test.

_____

_____

_____

_____

2. How will you explain latency?

_____

_____

_____

_____

Exercise

Fill in the blanks

1. _____ a tool to measure latency between user's system and remote destination.
2. To measure Internet connection's ultimate speed, like, _____ by accessing nearby test servers, speed tests are required.
3. _____ is a unit of measure for bandwidth.
4. 1 Mbps is the equivalent of _____ and _____ is equivalent of 1 Gbps (Gigabits per second).
5. In case of cable, check each end of the _____ connection for any looseness or damage.
6. Educate client by sharing some useful tips on _____ effectively.

4. Troubleshoot and Rectify Faults

TEL/N0113

Key Learning Outcomes

At the end of this unit, you will be able to:

1. State the importance and function of escalation matrix.
2. Understand the process of problem-solving.
3. Understand how to identify cables and connectors correctly.
4. Understand the importance of EMI and EMC.
5. Understand the process of crimping and soldering.
6. Demonstrate troubleshooting of cable and connector.
7. Demonstrate troubleshooting of CPE (Modem, Router, and Switch).
8. Demonstrate the troubleshooting of configuration and connectivity.

UNIT 4.1: Escalation Matrix

Unit Objectives ⊚

At the end of this unit, you will be able to:

State the importance and function of escalation matrix

4.1.1 Escalation Matrix

Escalation matrix is a process of set protocols and procedures which defines the steps while handling any potential dispute and/or problem. These are proved beneficial while dealing with issues and delays. This matrix usually takes care of the following types of problems and can be modified to include more fields as needed:

- Operational (scheduling, service cancellations, etc.)
- Logistical (delivery, in transit missing products, etc.)
- Technical (error messages, etc.)

Let us take Escalation Matrix Guideline of the company "Vistara" for example.

The Escalation Matrix allows you to specify more than one user to be contacted or notified in case of critical issues. This contact information is presented to the service delivery NOC when the service ticket is created or updated. This helps you notify the right people at the right time about critical errors. These alerts need to be informed about irrespective of the business hours. The point to note is that, the escalation matrix is time zone specific and is usually available 24 by 7. The key features of escalation matrix are as follows:

- The escalation levels are based on schedules.
- The service is available 24X7 and schedules are allocated accordingly.
- The schedules are time zone specific.
- You can now define multiple matrices for a given customer or partner.
- A matrix can be defined at more than one levels ranging from partner and customer level to a combination of sites, device groups and devices.

This implies that you can now have exclusive user group's notified of issues depending on device roles or locations or issue types.

To view the escalations list, go to **Navigation**:

- Log on to Vistara.
- Go to **Setup** option.
- Select **Escalation Matrix** (New**)**.

In the **Escalations List** page, a new column Applicable For is added to get a sneak peek into the customers, sites, device groups and devices associated with the escalation matrix.

4.1.2 Escalation Matrix Format

Let us take the sample escalation matrix format to understand it:

Problem Escalation Matrix

How to Use This Form

The left side of the columns reflects the time you spend waiting to reach someone before trying to contact someone else to help you solve your problem or resolve your issue. The right side of the columns reflect the time you spend not getting a resolution before you have to escalate to the next level.

Type of Escalation	1st Escalation Level		2nd Escalation Level		3rd Escalation Level		4th Escalation Level		5th Escalation Level		6th Escalation Level	
Operational	Project Team Contact		Project Manager		Account Manager		Sales Manager		Project Sponsor		Executive Level	
	¼ hr.	2 hrs.	¼ hr.	2 hrs.	¼ hr.	2 hrs.	¼ hr.	2 hrs.	½ hr.	2 hrs.	½ hr.	2 hrs.
Scheduling												
Obtaining Instructions												
Customer Information												
Service Information												
Obtaining Materials												
Performance Issues												
Service Cancellations												
Logistical	Project Team Contact		Project Manager		Account Manager		Sales Manager		Project Sponsor		Executive Level	
	¼ hr.	2 hrs.	¼ hr.	2 hrs.	¼ hr.	2 hrs.	¼ hr.	2 hrs.	½ hr.	2 hrs.	½ hr.	2 hrs.
Product Delivery												
DOA Product												
Missing Product												
Order Cancellations												
Order Verification												
Order Status												
Other												

Fig 4.1.1: Sample of an escalation matrix form

Tips

- In situations when there is an issue or incident which is not addressed with the given turnaround time, escalation polices/matrix ensure that the concerned person is updated about the matter.

- Any company, using Escalation Management tool(s) can make sure that any escalated task is reassigned within the time limit and ensure completions which will safeguard the company from facing a potential loss or embarrassment.

Exercise

1. What do you mean by escalation?

_____

_____

_____

_____

_____

_____

2. What is the need of preparing escalation matrix?

_____

_____

_____

_____

_____

_____

3. What kind of information can you get from an escalation matrix form?

_____

_____

_____

_____

_____

_____

UNIT 4.2: Problem Solving

Unit Objectives ⊚

At the end of this unit, you will be able to:

Understand the process of problem solving

4.2.1 Reporting the Problem

Typically, customers want that their problems should be easy to report, quickly acknowledged and timely acted upon with compassion and fairness.

Some ideas to achieve the key principles that can help a technician act on the reported problem and thus help in developing good complaints management systems are as follows.

Report the Problem

You should ensure that your contact details are readily available to the customers – e.g., in the appropriate section of the telephone book.

When the problem is reported

- Appreciate the customer for bringing the issues forward
- Handle the customer in an empathic and courteous manner
- Talk to the customer to understand the concern in detail, rather than purely relying on the written documents and previous records
- Be attentive and patient while customer is sharing the concern
- Probe to make sure you have clearly understood the problem
- Don't become judgmental, defensive, or put the blame on customer
- Acknowledge by narrating the summary of the problem to the customer
- Be responsive and share the action plan along with time frame to the customer

4.2.2 Solving the Problem

- Take ownership and explain your intentions to the customer
- Learn and understand the complete situation by referring to old records, if any
- Involve the customer to be a part of the solution, keep him posted about your steps
- Take verbal consent from the customer that he agrees with the solution which you propose
- Don't over-promise and stay within the limits of policies of the company. If the customer is over demanding and is asking for something which is not doable, explain the policies or take him/her to the company website. If he/she is still adamant, you may refer him/her to the Citizens Advice Bureau to check his/her legal rights

- In situations that have no legal obligations, one can offer a resolution that works best in customer favour. For example, if the customer is entitled for a repair, by law, one can offer him a replacement, keeping customer satisfaction in mind.

- Always give tentative timelines to the customer, rather than promising exact time frames. However, in case of delay, always make sure to keep the customer updated about the new timelines.

- Share the measure your company will take to ensure such situation(s) never arise in future.

4.2.3 Following up after the Problem

- Maintain a record of conversation including the important points along with the offered resolution.

- Make sure customer agrees to your method of solution to his problem.

- Records all the issues and complaints.

- These records will help in analysing the measures used for handling complaints and identifying products or services which are prone to more issues complaints.

- One will be able to identify the turnaround time for handling grievances.

Use the information to decide

- Do I have right resources to handle each issue?

- Is each team member aware of the protocols which need to be followed to resolve any situation/problem?

- Do I need to a refresher to update myself on the product?

- Should this brand be stocked?

Making repairs

Using the right kind of machinery for repairs ensures the work is done with the set quality standards and time limits. This is important for restoring customers' faith.

4.2.4 Checklist

The following checklist will come in handy in various type of trades and situations, when carry out repairs:

- Exhibit your understanding of the problem and respect urgency

- Explain briefly in a layman's term the cause and action plan for the customer's problem

- Share the time frame with the customer and take his/her verbal agreement on the same

- Inform about the cost involved in fixing the customer's issue in case he/she is not covered under warranty. It is advised to always give a quote in writing to avoid conflicts at the time of payment

- Be patient and informative while explaining the cause of the problem to the customer and never argue if he retaliates

- Thoroughly investigate the cause before fixing the problem and give precautionary advice, if necessary
- Do everything possible under your power to keep your promise
- Inform the customer in case there is any change in plan from the one decided at the beginning:
  - Always note contact details of the customer
  - Notify the customer once the issue is fixed
  - Give the customer record of the work performed
  - As an additional measure, ensure the customer has the manual. In some cases, you may also educate the customer about the steps performed to resolve the current issue and how to present it from reoccurring
  - Share your contact details and encourage the customer to update you in case the same issue arises

Tips

- While finding solutions to a problem one either uses a standard method or at times goes with ad hoc ones.
- Whether someone is involved in resolving a client's issue, offering support to the ones already involved in a resolution or finding new ways to solve a reoccurring problem, no what which stage you start from, but a fundamental part of every technician's role is to find ways to solve complications.

Exercise

1. What do you mean by problem solving?

_____

_____

_____

_____

_____

_____

2. List the problems which you can encounter in your work life.

_____

_____

_____

_____

_____

_____

3. Prepare a checklist for solving a problem.

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UNIT 4.3: Identifying and repairing faulty Cables and Connectors

Unit Objectives ◎

At the end of this unit, you will be able to:

1. Understand how to identify faulty cables and connectors correctly
2. Test the cables using signal level meters / OTDR
3. Repair and replace faulty connectors or damaged cables

4.3.1 Identify faulty cables / connectors

Cables/connectors are under a relentless rotation of heating and cooling, expansion and contraction. Whenever a switch is used or appliances are plugged in, usual result is that wire connections loosen over time.

Electrical system has a lot of precautions against bad cabling or connections hazards, such as grounding system, circuit breakers, and other standard protection. Yet, we can encounter sparking every time there is a loose wire connection in system.

Here are some common cabling / connector issues with recommended solutions:

1. Loose cable connections at Switches and Outlets

Screw terminal connections at wall switches and outlets become loose. These areas get maximum electric traffic, these are the first to be looked at. Loose wire connections at a switch, outlet, or light fixture are often signaled by a buzzing or crackling sound or by a light fixture that flickers.

To address this situation, first turn off the power to the suspected wall switch, light fixture, or outlet. Now remove the cover plate and use a flashlight to examine the screw terminals inside where the cables are connected. If there are any loose cables, tighten the screw terminals.

If device is made with the push-in fittings, remove them and reconnect the cables to the screw terminals on the device. If there are pass-through wire connections inside the box that are made with connector, check these to ensure the cables are tightly joined together.

2. Wire Connections Made with Electrical Tape

When wires are joined together with electrical tape rather than a wire nut or other sanctioned connector, there is a danger of a possible hazard. To address this situation, turn off the power to the circuit and remove electrical tape from cables and clean them. After getting sure of amount of exposed wire (about 3/4 inch), join the wires together with an approved connector.

If ends look damaged, remove the ends of wires and undress about 3/4 inch of insulation to make a Proper Connection.

3. **Two or More Wires Under One Screw Terminal**

There could be a situation when two or more wires are held under a single screw terminal on a switch or outlet. This can lead to distinct fire hazards. It is acceptable to have a single wire under each of the two screw terminals on the side of an outlet or switch, but it is a code violation to have two wires wedged under a single screw.

Immediately switch off the power. Remove two offending wires from their screw terminal. Cut a 6-inch wire of the identical color. Strip 3/4 inch of insulation from each end of the pigtail, then join one end to the two wires you just disconnected, using a wire connector. Attach the free end of the wire to the screw terminal that once held the two wires.

This creates a bridge connecting wires to the desired screw terminal on the outlet or switch.

4. **Loose Connections on Circuit Breaker Terminals**

When the hot wires on circuit breakers in the key service panel are not strongly connected to the breaker. In this case, lights flicker, or problems on fixtures all along the circuit are faced. After making connections to circuit breakers, ensure to strip the proper amount of wire insulation from the wire and make sure that only the bare wire is placed under the terminal slot before tightening.

To address this problem, turn off the breaker and then unclip it from the hot bus bar in the main service panel. She/he will check the hot wire connected to the breaker to validate that the screw is tight and that there is no insulation under the terminal and no exposure of excess bare copper wire. After the repair, put breaker back into place on the hot bus bar and turn the breaker back on.

5. **Faulty Neutral Wire Connections at Circuit Breaker Panels**

When the white circuit wire is not correctly mounted to the neutral bus bar in the main service panel, hazards are prone to occur.

To address the problem, the electrician will check to validate the neutral wire is sufficiently exposed and correctly attached to the neutral bus bar.

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Tips

- Make sure the pigtail wire is the same wire gauge as the circuit wires. A 15-amp circuit normally uses 14-gauge wire; a 20-amp circuit uses 12-gauge wire.

4.3.2 Cable testing using OTDR / signal level meters

OTDR

OTDR stands for Optical Time-Domain Reflectometer. It is an optoelectronic instrument for understanding the character of an optical fiber. For testing, continuous light pulses are injected into the optical fiber, and light is mined from the same end of the optical fiber. This light is either scattered or reflected along with the fiber. The scattered or reflected light demarcates the depiction of optical fiber.

Testing a Fiber Optic Cable

This test will acquire a trace of a single-mode or multimode fiber optic cable plant, including the loss of all fiber, splices, and connectors.

Equipment required to execute this test

1. OTDR of fiber to be tested
2. Use same fiber type and size as cable plant for launch and reference and need connectors compatible with the reference cables

Test Procedure

Step 1: Start the OTDR and allow it to warm up.

Step 2: Carefully clean connectors and adapters.

Step 3: Connect launch cable to OTDR. Connect receiving cable to the far end of the cable.

Step 4: Configure the test parameters on the OTDR.

Step 5: Connect wire to test to end of launch cable. Connect receiving cable to the far end of the cable

Step 6: Get a trace.

Signal level meters

The signal level meter is also known as Field Strength Meter (FSM). It is used for installation of new equipment in a network as well as for finding faults and for timely maintenance It also ensures that signal levels are delivered as required.

Types of Signal Level Meters
Commonly, Signal Level Meters are categorized in three groups:

1. **CCTV Signal Level Meters:** Today CCTV testers come with equipped functions to program the cameras and evaluate wide range of variables; thus, one device is enough. It is able to test and also program the cameras from a location with a particular device, thereby saving money and time.
2. **Satellite & CATV Signal Level Meters:** They are used to test and measure the quality of TV and satellite signals, ensuring that the signal levels are delivered as essential. Signal levels are measured over a definite frequency assortment, usually articulated in decibel-milliwatts, dBm.

   Guidelines to use a sound level meter:

   - position sound level meter at a sufficient distance from obstacles or reflectors

   - position microphone of sound level meter about 1.3 – 1.5 m above the ground

   - position microphone of the sound level meter in the direction of the sound source

4.3.3 Connecting a Cable to an RJ-45 Connector

Following tools are used to build cables with RJ45 connectors.

TOOLS
- Cat 3 cable or Cat 5 cable
- RJ45 connectors
- Wire stripping and crimping tool

Step 1: Cut the outer jacket of the wire by about 1 -1.5 inches by using a wire stripper.

Caution: Be careful while cutting the outer jacket, the wires inside the jacket should not get damaged.

Step 2: Before installing the wire, arrange them in the order in which they are supposed to go in the RJ45 connector.

Note: Arrangement of the wires order depends on the connection which you are making. The connection may be crossover, rollover or straight -through.

Step 3: After the wires are arranged in the specified order, cut them at least ½ inch from the point, which will be used for installation.

Step 4: Push the cables into the connector, for ensuring that the wires are below the gold crimping pins, towards the end of the cable and. One should confirm that each wire has gone into the right place.

Step 5: Specific tool should be used for crimping the cable. To check the connection, tug the cable slightly. Accordingly crimp again, if required.

Note: With the use of crimping tool, the wires are pressed into the plastic wedge and to the cable jacket. This keeps the cable in its place. The crimping pins are then pushed into the wires to respective connector channels.

The following figure shows installing cable in an RJ45 connector:
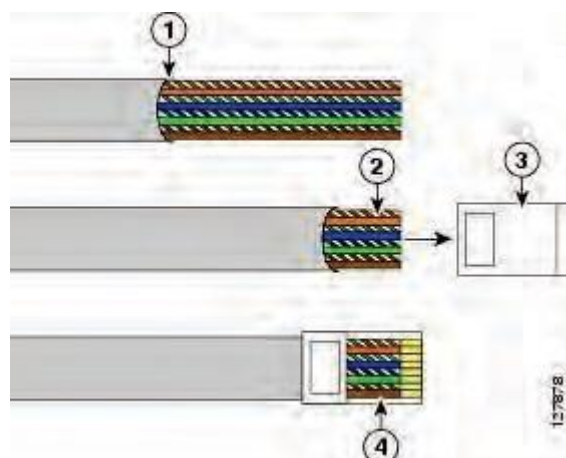
Fig 4.3.5: Illustration of installing a cable in RJ45 connector

1. Cut the outer jacket of the wire
2. Cut the wire into 1 and 1/2 inch in length
3. RJ45 connector
4. Cable installed in RJ45 connector

Tips

- The cable which is used to connect a computer to a router console is called as a rollover cable. It is also referred as null-modem cable.
- A twisted pair copper cable used for local area network (LAN) which has a RJ-45 connector at each end is referred to as Straight -through cable.

Exercise

1. How will you identify that cables and connectors are correctly placed?

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2. List the steps to connect cables correctly.

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3. List the steps to connect the connectors correctly.

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Fill in the blanks.

1. _____ is an optoelectronic instrument for understanding the character of an optical fiber.

2. The two types of Signal Level Meters are _____ and _____.

UNIT 4.4: Electro Magnetic Interference (EMI) and Compatibility (EMC)

Unit Objectives ◎

At the end of this unit, you will be able to:
Understand the importance of EMI and EMC.

4.4.1 Need of EMI & EMC

The most significant elements in electronic products and system integration are;
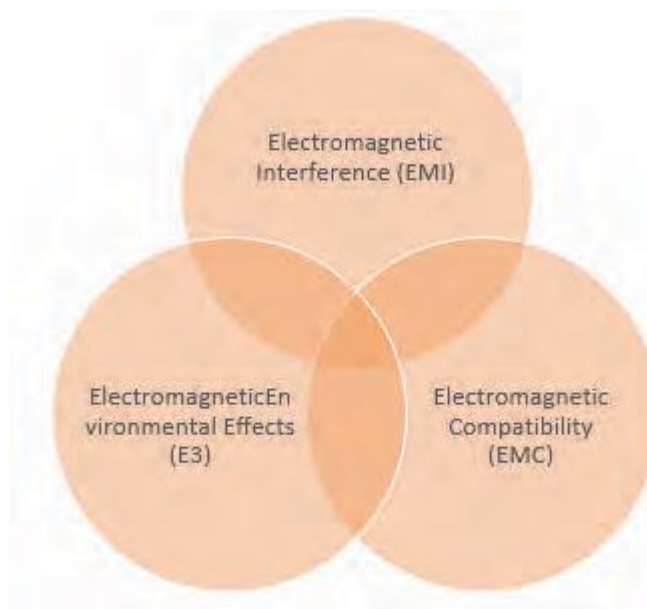
Fig. 4.4.1: Elements in electronic products and system integration

By law, any product, before entering the market must comply with international EMC standards. These standards are put into place to control and regulate the radiations which are emitted from every electronic product.

All electronic products should be immune to electromagnetic intrusion some of which are Electrical Fast Transients (EFT) and Electrostatic Discharge (ESD). The need for such is because these systems at times may get exposed to extreme electromagnetic environments (lightning strikes or (EMP) electromagnetic pulses) and they should be able to withstand the situation.

Both EMI and EMC are vital for product development companies across the world. Accurate guidelines must be adhered to by manufacturers while designing the product, which will ensure clearance of the product after EMI/EMC testing. Using EMI/EMC compliant components in the design have proven to be beneficial for many manufacturers.

All the details should be taken into consideration right from the initial stage; else one will be waiting time to meet such needs. The basic different between EMI/EMC are discussed as

following. The products under developments should always maintain specific military or industrial standards.

As mentioned, for all manufactured devices, EMI and EMC levels should always be verified by regular testing.

4.4.2 Electromagnetic Interference (EMI)

Electromagnetic Interference (EMI)

EM waves are radiated from mostly every device which can affect the working of the nearby wireless or FR systems. This phenomenon is referred to as EMI. Thus, EMI levels should be maintained within the limits to ensure the adjoining systems perform appropriately.
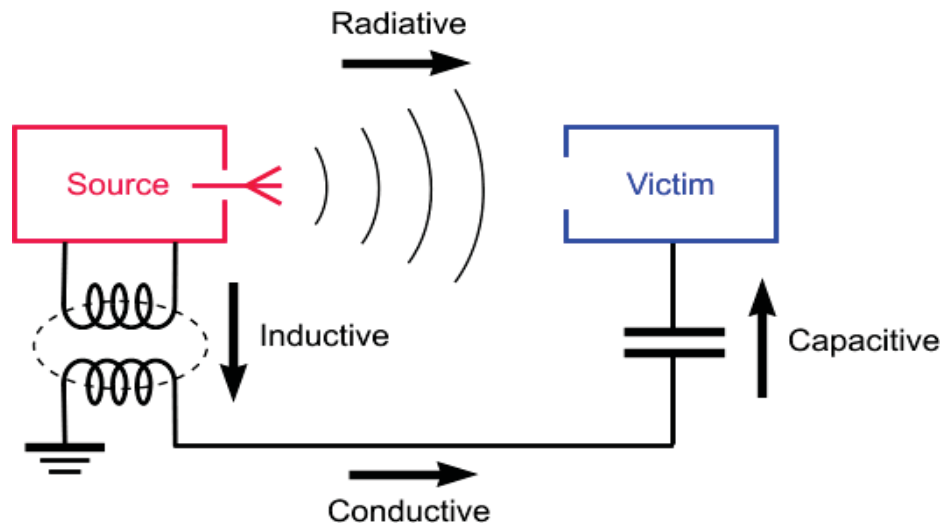
Fig 4.4.2: Electromagnetic interference

4.4.3 Electromagnetic Compatibility (EMC)

The electric noise produced by every device passes through cables, which can affect the working of adjoining devices connected to the same electric system. This is termed as EMC levels, and these should also be maintained within certain limits, for accurate functioning of the other systems.

Tips

- The EMC standards are required for trouble free co-existence and satisfactory operation. They are required to ensure compatibility between electrical and electronic control of all systems. Standards are required from manufacturers considering the user's interaction and knowledge on EMI will be in most cases very limited.

Exercise

1. What is EMI?

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2. What is EMC?

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3. What is the difference between EMI and EMC?

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UNIT 4.5: Crimping and Soldering

Unit Objectives ⊚

At the end of this unit, you will be able to:
Understand the process of crimping and soldering.

4.5.1 Crimping vs. Soldering

These days a defective coaxial connection is attributed for reducing performance of digital systems like Ethernet, Wi-Fi, and WLANs and also in high-end videos like DTV, SDTV and HDTV. In earlier days, an improperly installed CCTV connector caused a 1dB or less loss on a CCTV system. But, in recent days, the same bad connection can cause a 10dB loss on a 1GHz system.

Some essential factors which should be considered while establishing a coaxial connections and cable assemblies will be discussed in this topic.

Right tools and skills are the most crucial aspects whether someone is using soldering or crimping method for assembly.

Solder or crimp methods have proved to be more sustainable when it comes solid mechanical and electrical connections such as installing contact between the connector's centre to the centre conductor of the cable or assemblies which needs to preform over 1 GHz.

4.5.2 Soldering

This fabrication method is often considered the most labour-intensive as it is a preferred method while performing heavy-duty tasks and is reliable in making connections and can be applied on cable with solid or stranded centre conductors.

Advantages for connectorization by solder method are as follows:

	Preferred
	1. Solder is shiny and smooth around joint
	2. Outside joint there is no visible evidence of solder flow
	3. The hole created by solder filled with pin surface

Fig 4.5.1: Soldering

The prime tools in use is a solder iron with low-wattage and with variety of IPS. To hold the work in right place, installation is done by using a decent vise. Apart from this, only materials that are used are flux and solder.

	Preferred 1. Solder is shiny and smooth around joint 2. Outside joint there is no visible evidence of solder flow
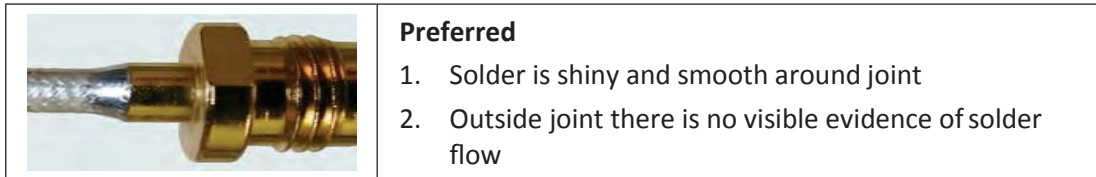
Fig 4.5.2: Joint after soldering

For non-optimum technique soldering is tolerant.

Disadvantages of solder method:

- While terminating soldering takes more time.
- In case of cold soldering there can be occurrence of solder not holding the joint properly.
- Solder fatigue and small cracks are evident in case of exposure to excessive vibration.
- In case of mechanical or temperature stresses soldering can become inconsistent.
- One should take precaution and control the heat while soldering as this can garble the cable.

	Nonconforming 1. Minimum 75% fill is observed in braid indicates 2. Contour of pin can be altered by cavity 3. Electricals also gets affected
	Nonconforming 1. Minimum 75% fill is observed in braid indicates 2. Contour of pin can be altered by cavity 3. Electricals also gets affected
	Nonconforming 1. Dielectric melted past OD + 20% maximum 2. Dielectric flare interferes with assembly 3. Pin gets melted with dielectric
	Preferred 1. 90-degree stripping is shown in dielectric 2. Melting is non-evident

Fig 4.5.3: Disadvantage of solder methods

4.5.3 Crimping

One of the most preferred methods to terminate connectors on coax cable sometimes also referred to as workhorse of the trade.

Following reasons explain why crimp method is popular:

• Reduction in installation time as soldering is not required.

• An experienced technician will not take more than fifteen seconds for installing a crimp to the crimp connector. Reduction in assembly time is essential because these days lesser number of technicians are required to retain more equipment. Categories like computers, network cables and digital videos are mostly crimped.

• In case of thermal cycling some good connections will keep the metal adequately past the yield point, still allowing enough space for "spring back".

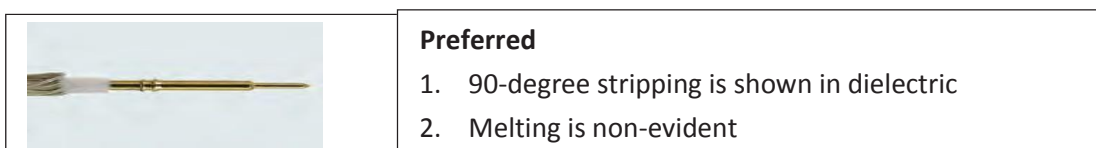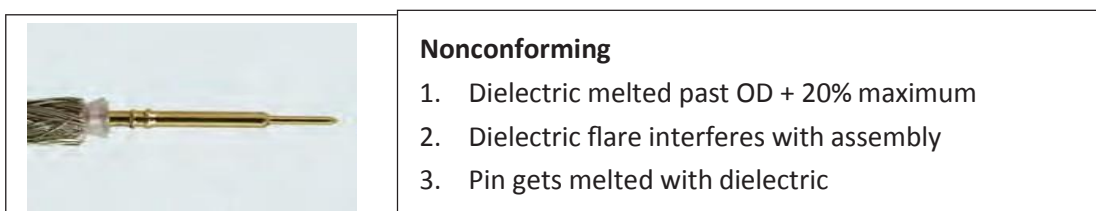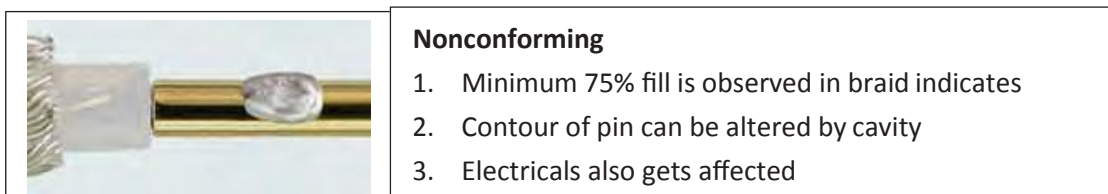• A crimp connection to be good should be air tight and does not wick: hence at time is also called as "cold weld".

• Can be used on solids and or marooned conductors.

	Preferred
	1. Equally distribution on the surface of all 6 crimp
	2. Crimp die positioned within pin step down
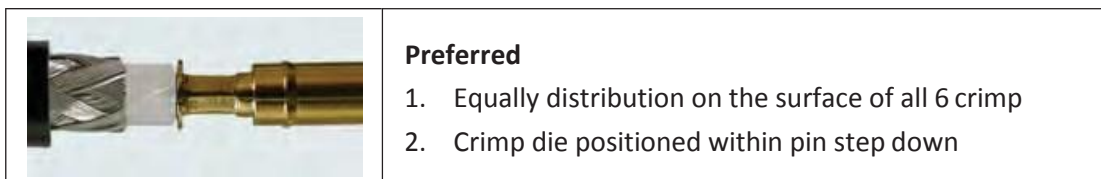
Fig 4.5.4: Crimping

Disadvantages of the crimp method are:

	Nonconforming
	1. Position of crimp die is outside crimp area
	2. Body of pin is no longer concentric
	3. Impedance of connector will be affected
	Nonconforming
	1. Once crimped you cannot bring the pin to its original shape
	2. "Dog ear" of excess material is visible at the point of crimp
	3. Possible cause can be too much pressure applied

Fig 4.5.5: Crimping disadvantages

In case the crimping is not done by a professional, there are chances that it will not seat accurately and may affect the specifications. This further affects the quality and continuity in the signal.

Once a wire is crimped it is not good for re-installation and also can't be un- crimped, so in case of repair the complete assembly needs to be replaced.

- Solid wires may not be able to hold the crimping, and this may lead to failure.
- Wire can shift and loosen in rare circumstances of frequent flex conditions. This is more evident in clamp connectors rather than crimped ferrule stud connectors.
- Always ensure to use the right type of connector for the coax. Avoid double crimping, particularly at the contact; this is known as "flagging" or "dog ears".

Fig 4.5.6: Visualization of flagging and dog ears

Ferrule Cross Section

1. Equal pressure with hexagon shape on all sides.
2. Ensure the crimping is done in such a way that "dog ear" is not formed.
3. Wrong crimp occurs either because of unequal pressure, inappropriate die or in some cause because of very hard ferrule material used.

It is vital to use right tools when connecting a crimping connector to ferrules. In case of normal duty work use a ratchet crimp tool such as the RFA -4005-20, and in case of heavy duty tasks apply a piston driven crimp handle, such as the RFA-4009-20. Make sure that the crimp die and connector are of right type.

To relieve stress on the coax a bell mouth crimped connector is used. Savings can be observed in case of cutting the material for large jobs in advance.

Fig 4.5.7: Bell mouth crimper

Tips

- A crimping tool is used for joining two pieces of metal together. The process involves deforming one or both cables to grip them. This process is referred to as crimping.

Exercise

1. What do you mean by crimping?

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2. What do you mean by soldering?

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3. How will you ensure that crimping and soldering have been done properly?

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Fill in the blanks.

1. The tools used in Soldering are _____, _____ and flux.

2. Crimping and Soldering are methods used to establish _____ connections.

UNIT 4.6: Troubleshooting of Cable and Connector

Unit Objectives ◎

At the end of this unit, you will be able to:

Demonstrate troubleshooting of cable and connector.

4.6.1 Problems during First Startup

Symptom	Problem	Solutions
All LED indicators are not working.	No power to router.	Perform the following tasks sequentially: 1. Ensure power switch is ON. 2. Ensure all connections are secure from the power supply. 3. Ensure there is no power cut. 4. If all above points are checked, then faulty power supply can be the reason.
Internet indicator not blinking	Issue with cable: • Either the cable is not connected in proper manner. • The cable is damaged.	Perform the following tasks sequentially: 1. Ensure the device is connected in accurate manner. 2. Check plugs and connectors 3. Ensure there is no physical damage to the cable.
No connection to Ethernet devices. (The indicators 1 to 4 are off)	Problem with cable • Either the cable is not connected in proper manner. • The cable is damaged.	Perform the following tasks in order: 1. Ensure device is connected accurately. 2. Check plugs and connectors. 3. Ensure there is no physical damage on cable.
Not able to connect to Internet	• Either the Ethernet switch or modem is not connected or switched on.	• Reconnect the modem or Ethernet switch again and confirm the power supply. • Check the Internet service.

Symptom	Problem	Solutions
	• Issue with broadband or WAN service. • Router is not configured in right manner.	• Re configure the Router.

Fig 4.6.1: Table showing problem during the first startup

4.6.2 Problems in Router

Symptom	Problem	Solutions
Issue with Ethernet connection. (Computer LEDs 1 to 4 are off)	A cable-related issue: • Disconnected cable. • Damaged cable.	Perform the following tasks in order: 1. Check if connections at either end are secure. 2. Check if the cable is not damaged.
Broadband or Ethernet connection is irregular or broken. (The Internet 1 LED on the front panel is off)	A cable-related issue: • Disconnected cable. • Damaged cable.	Perform the following tasks in order: 1. Check if connections at either end are secure. 2. Check if the cable is not damaged. If it is damaged, replace it with the new one.
(The Internet 1 LED is On but front panel LED is off)	Problem with broadband line or WAN service.	Check with the service provider to ensure the service is not interrupted.

Fig 4.6.2: Problems faced in router

Tips

• Types of network cables depend on the network's physical layer, size and topology. Different types of networks cables are coaxial cable, optical fibre cable and twisted pair cables. The devices can be at a smaller distance of few meters over Ethernet or large distances over the interconnections of the Internet.

Exercise

1. List various kinds of problems associated with cable and connectors.

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2. How will you troubleshoot problems associated with cables and connectors?

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UNIT 4.7: Troubleshooting of CPE (Modem, Router, Switch)

Unit Objectives

At the end of this unit, you will be able to:

Demonstrate troubleshooting of CPE (modem, router and switch).

4.7.1 Diagnosing the Cable Modem

On the front side of the modem, the status lights indicate the connection status between the modem network and also the connection between the modem, a computer and the local network.
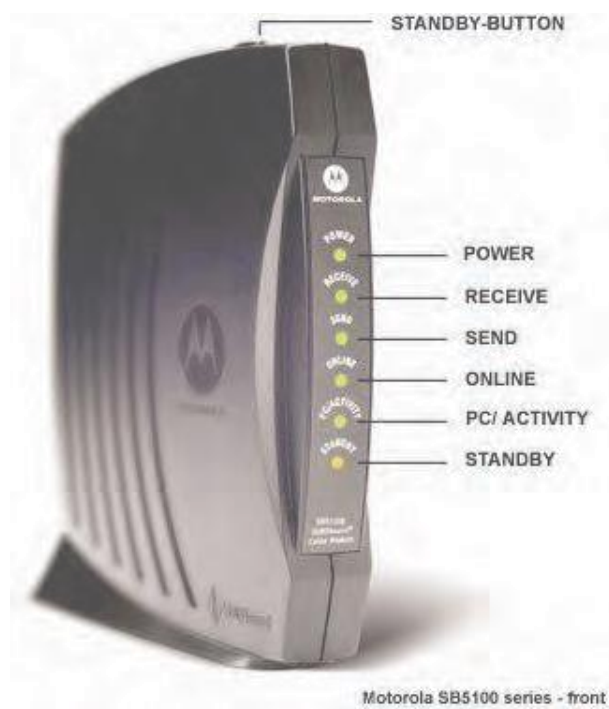
Fig 4.7.1: Front Panel

In normal operation, the status lights provide the information as in the table below.

Light	Flashing	On
Power	Startup diagnostics in progress.	The cable modem is powered on.
Receive	Downstream channel connection scan for receiving.	Connected downstream channel.
Send	Upstream channel scan connection.	Connected upstream channel.
Online	Network connection scan.	Process of startup is complete.
PC/ Activity	Receiving and communicating data.	Network device OR a computer is connected on the panel or either as USB or Ethernet connectors.
Standby	No flashing of lights	Once Standby button is on the Internet gets disconnected. If standby light is on, the rest of the lights will be off.

Fig 4.7.2: Status light information

Back/Rear Panel
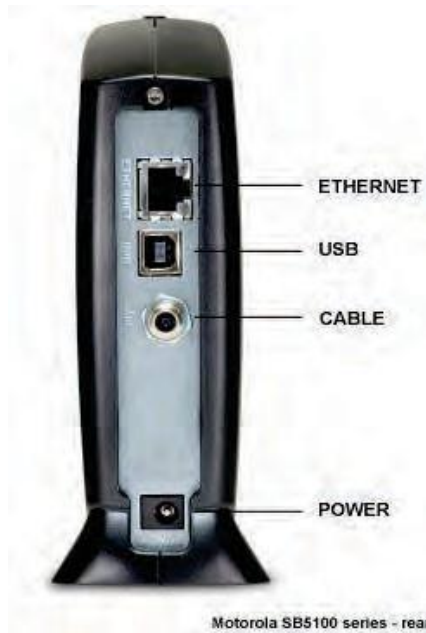
Fig 4.7.3: Rear Panel

Power socket and connectors for cable is found at the back of the panel .

Type	Description
Ethernet	For the computers that are Ethernet compatible, an Ethernet port initiates the connection with RJ-45 connector.
USB	USB compatible computers get USB connections through USB ports.
COAX Cable	The CABLE port ensures connection to the coaxial cable also coined as COAX cable.
Power	Modem gets its connection from the power port.

Fig 4.7.4: Ports at the back of the panel

The recommended connection type for Cable Broadband is Ethernet.

USB and Ethernet cable can't be used at the same time so never connect them to the same computer.

4.7.2 Troubleshoot a Cable Broadband Connection

Power Cycle Equipment

Occasionally, electrical devices will stop functioning properly, and cause a loss of connectivity. The first step in troubleshooting these issues is restarting the devices involved. This typically means that one needs to switch off the power for all devices such as the cable modem, router, switches, hubs and other systems. Then, after doing this, restart the devices after waiting for a minute, typically starting with the modem.

Once the modem is connected to the network, this will be indicated by four green lights (not blinking but solid) on the cable modem, network devices such as routers/switches can be restarted. Finally, restart the computer system.

Restarting or resetting the cable modem might take up to 5-30 mins.

Network Status

Unplanned network outages can interrupt the cable broadband service.

In the section below, you will find the solution for most common problems while the modem is not connected to the cable modem network.

4.7.3 Troubleshooting using the Cable Modem Indicators

The most frequent and common problems while the modem is not connected to the cable modem network are:

Modem Light	Status	Problem	Solution
Power	OFF	Show no power.	Confirm the supply of power.
	Flashing	Normal operation has been interrupted due to error.	Reset the modem after checking the coax cable.
Receive	Flashing	Searching for cable connection.	Check the cable connection and try resetting the modem.

Fig 4.7.5: Indicators on a cable modem

Tips

- In most of the routers the reboot process remains the same, which is done by unplugging the power supply to router, waiting for few seconds and then plugging in the cable back. In case of a modem which is connected separately, follow the same process for the modem.

Exercise

1. List the process to diagnose a cable modem.

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2. List the steps to be followed to troubleshoot cable modem indicator.

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3. List the steps to be followed to troubleshoot cable broadband connection.

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UNIT 4.8: Troubleshooting Configuration and Connectivity of CPE faults

Unit Objectives ⊚

At the end of this unit, you will be able to:
Troubleshoot configuration and connectivity.

4.8.1 Troubleshoot "No Data Transfer"

In the table below, you will find solution to most common problems while the modem is connected to the cable modem network, indicated by four solid green lights and the PC/ Activity indicator orange solid or flashing. No data transfer means you can't open a website in your browser, the email server can't be found to send or receive email, or another program can't connect to a server.

Modem Light	Status	Problem	Solution
Standby	ON	No data transfer.	Push the standby-button at the top.
	OFF	1. No connection between cable modem and computer or router. 2. Local area connection is disabled.	1. Check Ethernet or USB cable. If possible, try another cable. 2. Enable the Local Area Connection as below. Windows 7: Control Panel → Network and Internet → Network Connections Windows Vista: Control Panel → Network and Sharing Centre → Manage network connection Windows XP: Control Panel → Network Connections Windows 2000: Control Panel → Network and Dial-up Connections
	Blinking	An error has occurred during normal operation or can't connect to any server.	1. Check the cables and try resetting the modem. In case the cable is in right manner and the resetting also doesn't work one should call Customer Help. 2. Verify the connection settings and check if the connection is set up with the IP addresses assigned to the connection.

Modem Light	Status	Problem	Solution
PC/ Activity	Blinking	Can't connect to some servers	It is possible that servers on the Internet are down temporarily. Try to open a connection to the server after some time. You can also check connection with a server; it will give you: IP address, a trace route from your system.
	OFF	No coaxial cable connection	Check all connections of the cable and reset the modem.
Send	Flashing	Scanning for the upstream frequency.	Check all connections of the cable and reset the modem.
Online	Flashing	Scanning for the network connection.	Check all connections of the cable and reset the modem.
Activity	Blinking	Transmitting or receiving data	No Problem
Standby	ON	Modem is in standby mode (the other indicators are OFF)	Push the standby-button at the top.
			Computer to the server you can't connect to and the time the trace route has been done.
	ON	No data transfer	Unplug Ethernet or USB cable from computer and reconnect cable. Make sure the PC/ Activity indicator is blinking.

Fig 4.8.1: Troubleshooting steps

Tips

- In windows operated systems one can check the status of wireless network from control panel, network connection and ensure that it is enabled. If it is not enabled, right click and enable it. While using a laptop user must check the function key or physical button to ensure airplane mode is not on. In case of using a USB adapter, unplug the same and then reconnect.

Exercise

1. List the problems commonly associated with connectivity and configuration.

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2. How will you troubleshoot connectivity and configuration problems?

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UNIT 4.9: Troubleshooting and Repairing of Client's Broadband Service

Unit Objectives ⌖

At the end of this unit, you will be able to:

1. Understand common causes of broken Internet connection
2. Learn how to diagnose Internet connection

4.9.1 Common Causes of Broken Internet Connection

1. Slow Connection

These are the possible reasons why Internet connection would be ineffective:

- device is located far from router
- bandwidth is spread too thin, specifically if there are multiple devices connected
- Ultimate working hours where good population is connected at once, so congestion (e.g., libraries, hotels, universities, etc.)

2. No Connection at all

Connection is lost due to:

- Problems in router or modem
- Complete service disconnection, due to weather, construction work or power problems

3. Service Fluctuations

Challenges at Internet service providers' (ISPs) end, often result in irregular Internet speed

4. Equipment Failure

Damaged modem or router results in power blackout damaging the wires. Upgrading of outdated equipment is essential.

5. Operator Error

The most common operator errors that cause faulty Internet include wires plugged into the wrong jack, bad firewall rules set up and duplicating IP addresses.

4.9.2 Diagnosing Internet Connection

1. **Check equipment like the modem, the router, the line, and your device or computer.**

   For instance, network cables may be loose or accidentally unplugged.
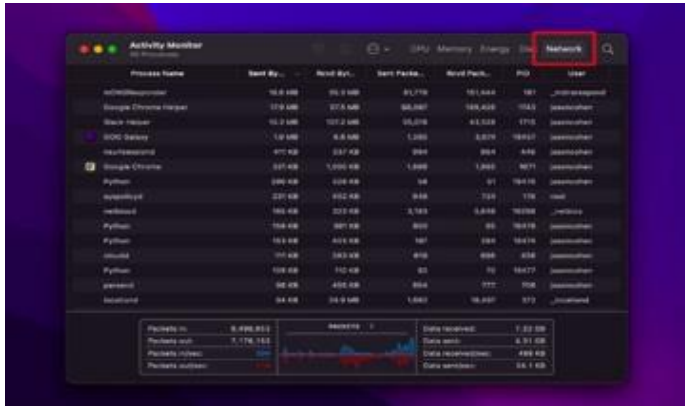
   Fig. 4.9.2a: Network screen
   Pic credit : https://www.pcmag.com/

2. **Check for functioning of website**

   Use the tool Down for Everyone or Just Me to check if the website is working. If it says the site is down just on your end, then proceed to diagnosing the problem.

3. **Use Ping command**

   The Ping command sends a small data from your computer to another, in order to see if there is a connection.

   To ping a website on a Windows computer: Search for CMD. On the black box, type "ping <www.website.com>" (e.g. ping www.google.com)

   To ping a website from a MAC: Open Applications, then Utilities, then Terminal. On the box, type "ping <www.website.com>" (e.g. ping www.google.com), then press enter.

4. If the box indicates "reply from" followed by numbers, then your Internet is working well. If it, however, indicates anything other than "reply from" (e.g. "request timed out" or "destination host unreachable"), then the problem is on your end.

5. **Check for DNS server problems**

    To check, access a website via its IP address. Google's IP address, for example, is http://216.58.197.78. If one can access the website via its IP but not through its URL, then DNS has issues.

6. **Check Internet package**

    If Internet is working, but is slower than expected, log on to a site like Speedtest.net and run a speed test. Number in megabits per second denoting the speed of system will be shared.
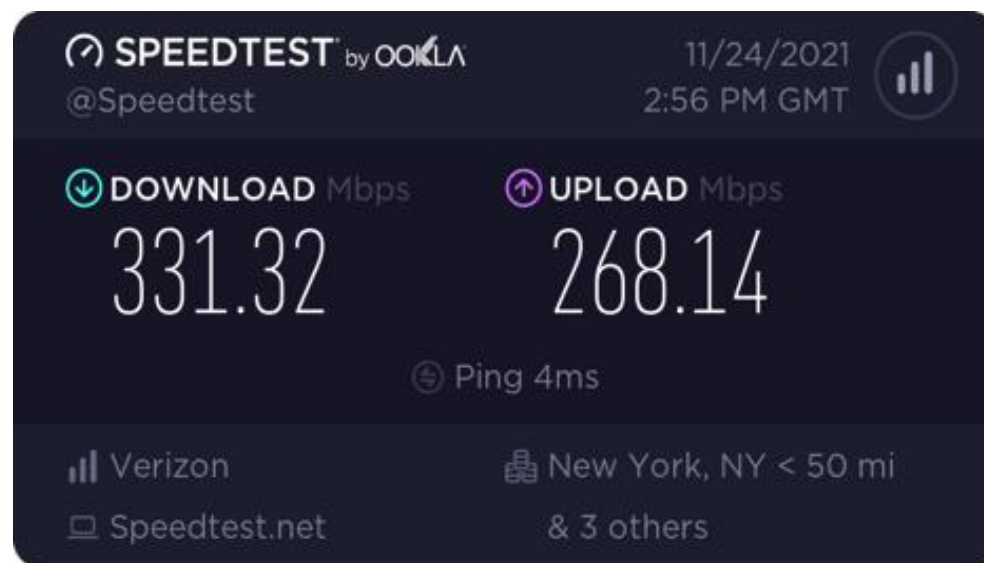
Fig.4.9.2b: Speed Test screen

Exercise

1. Name a few common causes of broken Internet Connection.

    _____

    _____

    _____

    _____

    _____

2. Name a few things to check while diagnosing Internet connection.

    _____

    _____

    _____

    _____

    _____

5. Plan Work Effectively, Optimize Resources and Implement Safety Practices

TEL/N9101

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain about the work place health and safety

2. Differentiate various health hazards

3. Demonstrate various first aid techniques

4. Importance of safety at workplace

5. Understand Basic hygiene Practices and hand washing techniques

6. Explain the need for social distancing

7. Understand the reporting of hazards at workplace

8. Explain e-waste and process of disposing them

9. Explain Greening of jobs

UNIT 5.1: Workplace health & safety

Unit Objectives ⊚

At the end of this unit, you will be able to:

- Understand about workplace health and safety
- Explain tips to design a safe workplace
- Explain precautions to be taken at a workplace

5.1.1 Safety: Tips to Design a Safe Workplace

Workplace health and safety policy defines the best possible work conditions and safety for the employees. Employees have a right to feel safe in their workplace. Hence the organizations create and follow legal standards and ensure a hazard-free workplace.

Every organization is obligated to ensure that the workplace follows the highest possible safety protocol. When setting up a business some tips to remember:

- Use ergonomically designed furniture and equipment to avoid stooping and twisting
- Provide mechanical aids to avoid lifting or carrying heavy objects
- Have protective equipment on hand for hazardous jobs
- Ensure presence of emergency exits and they are easily accessible
- Set down health codes and ensure they are implemented
- Follow the practice of regular safety inspections in and around the workplace
- Get expert advice on workplace safety and follow it
- Get regular inspection of electrical wiring and also the electrical switches and gadgets
- Install fire extinguishers and fire alarms.

5.1.2 Precautions to be taken while at work

Every employee is obligated to follow all safety protocols put in place by the organization. All employees must make it a habit to:

- Immediately report unsafe conditions to the supervisor
- Recognize and report safety hazards that could lead to slips, trips and falls
- Report all injuries and accidents to the supervisor
- Wear the correct protective equipment when required
- Learn how to correctly use equipment provided for safety purposes
- Be aware of and avoid actions that could endanger other people
- Always be alert
- Educate the employees about the first/emergency exits on the floor, and also where the fire extinguishers are kept.

Tips

- Be aware of what emergency number to call at the time of a workplace emergency
- Practice evacuation drills regularly to avoid chaotic evacuations

UNIT 5.2: Different types of Health hazards

Unit Objectives ⊚

At the end of this unit, you will be able to:

1. Understand the health hazards
2. Demonstrate First Aid Techniques

5.2.1 First Aid

Illness, injuries, and pain are part of human life. This can happen anyway. Every individual is prone to illness and injuries at any time and anywhere.

In case of any of these, some kind of immediate medical attention or treatment is needed to reduce the discomfort, pain, and deterioration of the condition. The medical attention that is given at the first instance before seeking professional medical help is called "First Aid". First aid is the immediate and temporary treatment given to the victim of an accident or sudden illness while awaiting the arrival of "Medical Aid". First Aid means providing the initial treatment and life support for people with an injury or illness. However, First Aid has its limitations and does not take the place of professional medical treatment. Proper early assistance given by First Aider helps in saving the life of a patient.

Illness and injuries can happen anywhere, be at home, the workplace, or in the market place. Whatever safety measures we adopt, we are all prone to illness sometime or the other. Some common injuries and their rescue techniques:

5.2.1 First Aid Techniques

- o Direct pressure must be applied to the cut or wound with a clean cloth, tissue, or piece of gauze, until bleeding stops.
- o If blood soaks through the material, it is highly recommended not to remove it.
- o More cloth or gauze must be put on top of it, and pressure must be continued.
- o If the wound is on the arm or leg, the limb must be raised above the heart to help slow the bleeding.
- o Hands must be washed again after giving first aid and before cleaning and dressing the wound.
- o A tourniquet must not be applied unless the bleeding is severe and not stopped with direct pressure.

Click/Scan the QR code to know more about First Aid techniques

Fig. 5.2.1a: Clean cut or wound

Clean cut or wound

- o The wound must be cleaned with soap and lukewarm water.
- o To prevent irritation and burning sensation, the soap solution must be rinsed out of the wound.
- o Hydrogen peroxide or iodine must not be used to clean or treat the wound since they are corrosive and can damage live tissues.

Fig. 5.2.1b: apply hydrogen peroxide or iodine

Protect the wound

- o Antiseptic cream or solution must be applied to the wound to reduce the risk of infection.
- o Then the wound must be gently covered with a sterile bandage.
- o Till the wound heals, the bandage must be changed (dressed) daily to keep the wound clean and dry.

Fig. 5.2.1c: Protect the wound

Call the Emergency Helpline if:

- o The bleeding is severe and deep
- o You suspect Internal Bleeding
- o Abdominal or Chest wound exists
- o Bleeding continues even after 10 minutes of firm and steady pressure

For Burns:

- o Immediately put the burnt area under cold water for a minimum of 10 minutes
- o If the burned area is covered, take clean scissors, cut and remove the fabric covering the area
- o In case clothing is stuck to the burned area, leave it as it is
- o Before sterile dressing application, remove jewellery (if any)
- o It is better to leave the burned area open
- o Do not apply any medication or ointment
- o Breaking a blister – it is an absolute no-no!

Fig. 5.2.1d: Put Burnt Area under Water

For Broken Bones and Fractures

- • **Protruding bone must be left alone**
- o If a bone has broken through the skin, it must not be pushed back into place.
- o The area must be covered with a clean bandage and immediate medical attention must be sought.
- • **Bleeding must be stopped**
- o Steady and direct pressure must be applied with a clean piece of cloth for 15 minutes and the wound must be elevated.
- o If a blood soaks through, one must apply another cloth over the first and seek immediate medical attention.
- • **Swelling must be controlled**
- o The RICE (Rest, Ice, Compression and Elevation) therapy must be applied to control and reduce swelling.
- o Rest the injured part by having the person stay off of it.
- o Ice must be applied on the area with the help of an ice pack or by wrapping the ice in a clean cloth. Ice must not be directly placed against the skin.

For Heart Attack/Stroke

- Think FAST. Face: is there weakness on one side of the face? Arms: can they raise both arms? Speech: is their speech easily understood? Time: to call Emergency helpline
- Immediately call medical/ambulance helpline or get someone else to do it
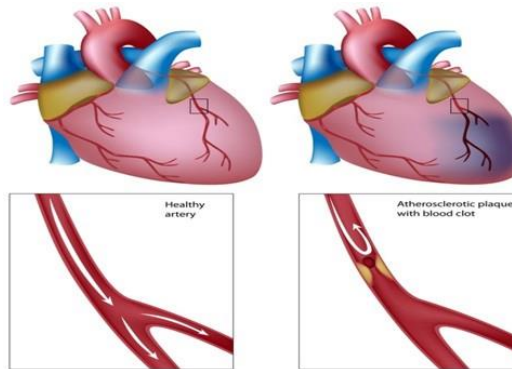
Fig 5.2.1e: Anatomy of Heart Attack

For Head Injury

- Ask the victim to rest and apply a cold compress to the injury (e.g. ice bag)
- If the victim becomes drowsy or vomits, call Medical helpline or get someone else to do it

Steps of using breathing apparatus:

Check the parts of the breathing apparatus thoroughly.

Check the bypass knob (red). Close it if you see it open. After this, press the reset button (area above bypass nob – black)

Inspect the facemask to see that it is undamaged.

Lift the cylinder ensuring that on the top the cylinder valve should be present. The back plate of the cylinder should face the wearer.
Wear the breathing apparatus on the shoulder like a bag pack and by the neck strap, hang the facemask.

After wearing the breathing apparatus tighten shoulder straps and fasten the waist belt.

The cylinder valve should be opened slowly to inspect the pressure gauge.

Make sure that 80% of the cylinder is full.

Wear the mask slowly by resting your chin in the resting cusp and pull the head strap slowly over your head.

Pull the head straps for a snug but comfortable fit.

Breath in and normally to see if you can breathe normally or not.

Now insert a finger sidewise of the facemask for easy outward airflow.

Slowly close the cylinder valve without leaving the knob.

Be steady for 10 minutes and hold your breath or extremely slow to listen to any wheezing sound.

Also, check the pressure gauge for any dip in the pressure.

Normally Breathe to vent system
Listen for a whistle alarm while observing the pressure gauge
at 55 bar (+/-5 bar)

Briefing and Guidance for Fire Fighters

There are basically three methods with the help of which people can be rescued from a building engulfed in a blazing fire. To ensure on-site reception, here are two of the important steps that we will discuss now. These come under the best safe lifting and carrying practices.

Conventional Technique: This is a good method if there is an open area close by. The first rescuers will make the victim sit reach under their armpits and finally, grab their wrist. The other rescuer will cross the ankle (victim), pull up that person's legs on his shoulder. Finally, on the count of 3, both will lift the person up and move out.

Fig. 6.2.1f: Fast Strap

Fast Strap: In case the victim is completely incapable of moving out of the fire zone. The rescuers should follow this method. One of the rescuers will place their knee between victim's shoulder and head. Pin the loop of webbing to the ground with the help of the knee. This acts as an anchor. With the non- dominant hand hold the other end of the webbing and make a loop. With steady hands, pull the victim's hand in from the loop, tie it securely and finally clip the webbing loops.

Fig. Fast Strap

Essentials for Smooth Evacuation: The following are essential to have a smooth evacuation during an outbreak:

- Clear passageways to all escape routes
- Signage indicating escape routes should be clearly marked
- Enough exits and routes should be present to allow a large number of people to be evacuated quickly
- Emergency doors that open easily
- Emergency lighting where needed
- Training for all employees to know and use the escape routes
- A safe meeting point or assembly area for staff
- Instructions on not using the Elevator during a fire

Special Evacuation Requirements For Specially Abled Persons

- **The Visually Impaired**
  o Announce the type of emergency
  o Offer your arm for help

- **With Impaired Hearing**
  o Turn lights on/off to gain the person's attention, or indicate directions with gestures, or write a note with evacuation directions

- **People with Prosthetic Limbs, Crutches, Canes, Walkers**
  o Evacuate these individuals as injured persons.
  o Assist and accompany to evacuation site if possible.
  o Use a sturdy chair, or a wheeled one, to move the person to an enclosed stairwell
  o Notify emergency crew of their location

5.2.2 Importance of Fire Safety Drills

Fire drills are indispensable in any workplace or public building for rehearsing what to do in the event of a fire. They are also a lawful obligation under the Fire Safety Order of 2005 and all workers in a company must partake. Here's how to get the most out of your fire practice.

Why have fire drills?

There are numerous reasons why fire drills are vital; first of all, fire drills are a chance to practice evacuation techniques to make sure all staff are acquainted with them. The staff will vacate the building quickly and therefore in a real life situation panic will be decreased, as everyone will know what they need to do. Fire drills are also beneficial for testing escape methods to assess their efficiency.

During fire drills, checks can also be carried out on alarm systems to make certain they are working properly and that emergency exits are passable. Overall fire drills help increase safety, so that you will be best equipped if a real fire does happen.

How often?

Ideally there should be two fire drills a year, although this may vary according to the workplace and after checking the firm's risk assessment. If there are people who work in shifts, suitable preparations should be made to ensure all staff partake in at least one fire drill per year and to educate them as to how to handle the situation.

Should you inform staff beforehand?

There are arguments for and against making people conscious of fire drills before they take place. Some people contend that not notifying staff gives an element of surprise, so that people take drills more sincerely. However, this can also have the reverse effect in a real fire, as on overhearing the alarm people may reason that it's only a drill.

The benefit of notifying all staff of fire drills in advance is that initially, they will not panic, which circumvents potential injuries that could be instigated in a rush to exit a building. Furthermore, if the alarm sounds, lacking a prior warning, there will be no uncertainty as to if it is a drill or not and people will act correctly. In public places such as shopping centres, it is prudent to make members of the public alert when a drill is about to happen.

UNIT 5.3: Importance of Safe Working Practices

Unit Objectives ⊘

At the end of this unit, you will be able to:

1. Explain Basic Hygiene Practices

2. Understand the importance of Social Distancing

3. Demonstrate the safe working practices

5.3.1 Basic Hygiene Practices

We are living in an environment with millions of germs and viruses. And our body can be a breeding space for these microbial organisms. They grow and multiply and cause many diseases which sometimes can prove to be fatal for the human beings. These disease-causing microbial organisms kill over 17 million people every year. Some simple hacks and little changes of basic personal hygiene habits can bring amazing changes to all of us. We can prevent contracting these diseases if we follow these hygiene practices every day.

Personal Hygiene

Personal hygiene is all about managing your body hygiene, essentially caring for your well-being incorporating some physical hygiene habits. Also, there are mental health benefits as well, as they affect each other immensely.

What are good personal hygiene habits?

Good personal hygiene includes but not limited to-

- Take regular shower
- Maintain oral hygiene
- Wash your hands frequently
- Wash your genitals
- Keep your clothes and surrounding dry and clean

These habits should be practiced on a regular basis, at home, at work, basically where you are! That's the whole idea of preventing your body system collapse over a tiny microbe!

Personal Hygiene Practices at Home

Your home should be the most comfortable and convenient for you to keep up your personal hygiene level to a standard, yet, we find ourselves procrastinating over hygiene issues when we are at home. Even though some of these tasks barely take a minute.

1. **Take Regular shower**

Do not wait up to feel the dried sweat in your body to feel the urge to take shower, make it a routine, you have the choice to either take them before you head to work or after the long day or even before you head to sleep, whichever one suits your routine. Make sure to rinse your body thoroughly, especially the genitals and underarms as they produce more sweat and are more prone to fungal activities.

2. **Wash your hands frequently**

We use our hands to do our most physical acts, from picking up the keys, browsing through our phones, cooking or eating to attending our pets. While we agree and accept the importance of washing hands before eating and after visiting the toilet, it is also *important to wash our hands* with soap or sanitizer every now and then. The pandemic covid-19 which crippled the life all over the world has taught us an important lesson that sanitizing our hands regularly is the only way we can avoid transmission of the disease. Use *alcohol based sanitizer* to wash hands well to prevent the spread of communicable diseases

How to 7 steps handwash with soap and water

1 Rub hands palm to palm

2 Rub palm to back of hands

3 Palm to palm, fingers interlaced

4 Fingers interlocked

5 Thumbs clasped in palm

6 Fingers into palms

7 Rub wrist

5.3.1 7 steps for Handwashing

3. Maintain oral hygiene practices

It is very important to take care of the teeth and gum, to prevent tooth decay and bad odour. Just brushing them twice a day is not enough, but using fluoride toothpaste and brushing properly is very essential. And wash it well with water to remove any food particles that is stuck in the gap in between the teeth. It is advised to wash the teeth everyday twice to maintain healthy teeth and gum.

Click/Scan the QR Code to know handwash techniques

4. Nails and hairs hygiene

The cleanliness of nails and hair is also very important. They store dirt and grease. And even the microbes could be in there stuck and spreading. If the nail is not clean they can cause severe food poisoning, as we use our hands to eat food. Trim the nails once in a fortnight and wash hair at least twice a week with a shampoo to keep them healthy

5. Nose and ears hygiene

Wherever we are most likely to breathe in some pollutants, and most of the particles are bound to be stuck in the nasal hair. So, rinse the nose and ear with warm water once you return from outside.

6. Wear fresh and clean clothes

Changing into neat and clean clothes will prevent many infectious diseases. It will also give the mental effect immediately and it will boost the mind. Wash clothes with a good detergent every day and dry it in the sun. This will ward off any microbes attached to the clothes. If possible, Dettol can be used while rinsing which is an anti-disinfectant.

7. Food hygiene

You can get severely sick from food-borne diseases, as most of your foods are raw, purchased from outside, they risk being cross-contaminated with harmful microbes. Food hygiene is basically the idea of better storage, handling, and preparation of food to prevent contamination and to prevent food poisoning.

5.3.2 Importance of Social Distancing

Preventing communicable diseases:
All these above practices will help us to prevent communicable diseases. These diseases are highly infectious and contagious and spread through air, urine, feaces, saliva, skin (through touch) and using same towels and utensils.

Social Distancing and isolation, Self-Quarantine:
Ever since the spread of the pandemic covid-19, several health organisations have been insisting on following social distancing and isolation. Communicable diseases mainly spread through coming close to the infected individual and through physical touch. If a person is infected with diseases like normal flu or cold and spread it to others, the symptoms and may remain with the infected person for a day or two. The virus may be destroyed by taking an antibiotic. But in severe cases like corona virus the infection is severe and can prove fatal to the affected people. To prevent the spread of the virus, the entire world adopted lockdown, *social distancing* and compulsory face mask. And the infected person has to be in *self isolation* and *quarantine* till the time the symptoms are over. This was the advisory from the World Health Organisation, and the entire world followed it to prevent the rapid spread of the virus. The same can be applicable to all types of communicable diseases that are spread mainly through air and touch.

As communities reopen and people are more often in public after the pandemic, the term "physical distancing" (instead of social distancing) is being used to reinforce the need to stay at least 6 feet from others, as well as wearing face masks. Historically, social distancing was also used interchangeably to indicate physical distancing which is defined below. However, social distancing is a strategy distinct from the physical distancing behavior.

What is self-quarantine?
Self quarantine was imposed on people who have been exposed to the new covid-19 and who are at risk for getting infected with the virus were recommended to practice *self-quarantine*. Health experts advised the self-quarantine for 14 days or two weeks. Two weeks provides enough time for them to know whether or not they will become ill and be contagious to other people.

self-quarantine was also recommended for people who have recently returned from traveling to a part of the country or the world where COVID-19 was spreading rapidly, or if a person has knowingly been exposed to an infected person.

Self-quarantine involves:

- Using standard hygiene and washing hands frequently
- Not sharing things like towels and utensils
- Staying at home
- Not having visitors
- Staying at least 6 feet away from other people in your household

Once your quarantine period has ended, if the symptoms are not there, then the person may return to normal routine as per doctor's advice.

What is isolation?
Anybody who is infected with a contagious disease needs to practice isolation in order to prevent the spread of the germs to their near and dear ones. This became very popular and was strictly adhered to during the covid-19 pandemic. People who were confirmed to have COVID-19, **isolation** was mandatory. Isolation is a health care term that means keeping people who are infected with a contagious illness away from those who are not infected. Isolation can take place at home or at a hospital or care facility. Special personal protective equipment will be used to care for these patients in health care settings. They are attended by well trained nurses and specialised doctors. And these people have to be in the PPE kits all through their presence in the hospital.

Complete PPE Kit

Complete PPE Kit

Disposing off the PPE Kits

The PPE kits are worn by health workers and doctors who are attending to patients with highly infectious diseases and who are kept is isolation in order to arrest the spread. They have to wear it every time they go near the patient and have to remove it once their duty is over. Most of the PPE components are used for single use, however the face mask and goggles can be reused provided they are sanitised properly. The PPE kits have to be disposed off safely as they might have contaminants stuck to them and they may infect the healthy person if they are not discarded properly. The health workers may be all the more vulnerable to contact the disease.

5.3.3 Safe Workplace Practices

Every company has the provision of first aid box. As you have already read about the types of injuries that technicians can receive in their field of work, it is imperative for the companies to have appropriate first aid accessories.
The basic first aid supplies and accessories that a first aid box should have are:

Supplies and Accessories in the First Aid Box

Splint

Elastic wraps

Latex gloves

Adhesive tape

Tweezers

Blanket

Scissors

Wound cleaning agent

Triangular bandages

Gauze roller bandage

Adhesive bandages

Gauze pads

Antiseptic cleansing wipes

Burn cream or gel

Eyewash liquid

CPR Kit

Chemical hazards are caused by toxic materials, which are poisonous. And being poisonous in nature, they can either be fatal or cause serious damages in case the preventive actions are not taken on time. Now, the exposure to chemicals can be in 3 forms.

They can be:

- Inhaled (entering the body through nose)
- Directly in contact with skin
- Ingested (consumed)

The symptoms, in this case, will be:

- Seizures
- Partial or complete loss of responsiveness
- Burning sensation
- Stomach Cramping with bouts of excruciating pain
- Nausea
- Vomiting (and in times with blood-stains)

Now, where there are problem, their solutions come side by side. In such situations, the person giving first aid requires to be calm and take certain preventative actions.

Some of the essential actions are:

- Using insulated equipment
- Wearing protective clothing, goggles, masks, shoes and gloves
- Ensuring the place has enough ample ventilation

Remedial action

- The foremost thing that one should do is to provide immediate first aid. However, it is to be remembered that the victim should not be given any kind of fluid (water, milk) until doctors from Poison control unit gives a green signal.
- Aside from this, there are a few things a person can perform to the victim of toxic material exposure.
- Remove the victim from the toxic zone or vicinity
- Call for an ambulance
- Remove contaminated clothing
- Splash water in the eyes
- If ingested, do not try to make the victim puke (vomit)
- Wash their mouth with water

Fig. 5.3.2: CPR

- In case the victim's breathing has stopped, give CPR (Cardiopulmonary resuscitation)
- In case of burning due to toxic material, apply burn gel or water gel on that area.
- Avoid any cream based or oil based lotion or ointment

  Even though giving first aid is the right thing to do in the first place, it is also important to report the incident to their supervisor.

Exercise

1. Burnt area should be kept under _____for a minimum of 10 minutes

2. _____exits should be easily accessible in case of fire.

3. _____ or _____ must be applied to the wound to reduce the risk of infection

4. The RICE which is _____,_____,_____ and _____ therapy must be applied to control and reduce swelling.

5. CPR is _____.

Click/Scan on QR Code to know more about CPR

UNIT 5.4: Reporting Safety Hazards

Unit Objectives ◎

At the end of this unit, you will be able to:

- Discuss the process of reporting in case of emergency (safety hazards)
- Understand methods of reporting hazards

5.4.1 Methods of Reporting Safety Hazards

Every organization, from every industry, has a standard reporting protocol, comprising the details of people in the reporting hierarchy as well as the guidelines to be followed to report emergencies. However, the structure of this reporting hierarchy varies between organizations, but the basic purpose behind the reporting procedure remains same.

The general highlights of the Organizational Reporting Protocol, commonly known as the 6Cs, are:

- Communicate First
    - The first source of information during emergency is the preferred source.
    - Crises situations are time-bound and hence it is important to communicate promptly.
- Communicate Rightly
    - Distortion of information due to panic must be avoided.
    - Proper, accurate information must be provided to concerned authorities and this can save lives.
- Communicate Credibly
    - Integrity and truthfulness must never be forgotten during emergencies.
- Communicate empathetically
    - One must wear the shoes of the victims while communicating emergencies.
- Communicate to instigate appropriate action
    - Communicating to the right authorities help in taking the necessary action.
- Communicate to promote respect
    - Communicating with the victims with respect help in earning their trust and thus eases the disaster management process.

Hazards and potential risks / threats can be identified and then reported to supervisors or other authorized persons in the following ways:

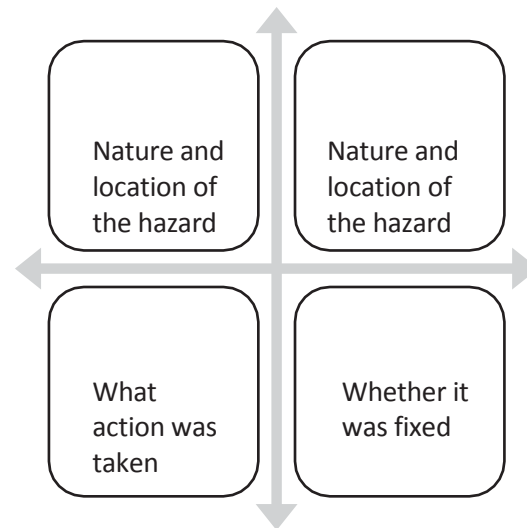While identifying and reporting a hazard / potential threat / potential risk, one must describe the following:

Fig. 5.4.1a: Describing hazard matrix

Part A: To be completed by the Worker Details Required:

- o Name of Worker
- o Designation
- o Date of filling up the form
- o Time of incident / accident
- o Supervisor / Manager Name
- o Work Location / Address
- o Description of the hazard / what happened (Includes area, task, equipment, tools and people involved)
- o Possible solutions to prevent recurrence (Suggestions)

Part B: To be completed by the Supervisor /

Manager Details Required:

- o Results of Investigation (Comment on if the hazard is severe enough to cause an injury and mention the causes of the incident / accident)

Part C: To be completed by the Supervisor /

Manager Details Required:

- o Actions taken / Measures adopted (Identify and devise actions to prevent further injury, illness and casualty)

Action	Responsibility	Completion Date

Any job role and any occupation in this world have some hazards, in varying severity, associated with it. These are called Occupational Hazards. Occupational Hazard can be defined as "a risk accepted as a consequence of a particular occupation". According to the Collins English Dictionary, it is defined as "something unpleasant that one may suffer or experience as a result of doing his or her job". Occupational Hazards are caused by the following:

Hazard Report Form

Name:	Date:

Location:

Tool/Equipment:

Description of the hazards:

Suggested corrective action:

Signature:

Supercisor's remarks:

Corrective action taken:

Signature of Supervisor:	Date:

Fig 5.4.1b: Sample form of reporting hazards

UNIT 5.5: Waste Management

Unit Objectives ⊚

At the end of this unit, you will be able to:

- Understand what is e-waste
- Understand the concept of waste management
- Explain the process of recycling of e-waste

5.5.1 Introduction to E-Waste

Electrical and electronic products are all around us. We can't imagine a world without these gadgets. Our life is indispensable without electricity and electronic devices. Growth in the IT and communication sectors has increased the usage of electronic equipment immensely. Frequent change on the technological features of electronic products is forcing consumers to discard their old electronic products very quickly, which, in turn, adds to e-waste to the solid waste pool. What this translates to is mountainous masses of electrical and electronic waste which has a high potential to pollute the environment. This growing menace of e-waste calls for a greater focus on recycling e-waste and better e-waste management.

E-waste means electrical and electronic equipment, whole or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment, and repair processes. E-waste usually is made up of usable and non-usable material. Some of the waste if left unattended will be destructive to the environment. E-waste is made up of hazardous substances like lead, mercury, toxic material, and gases.

There are many companies these days who are engaged in the collection, handling, and disposal of this e-waste in a safer and more secure place to protect the environment.

5.5.2 What is E-Waste?

The amount of e-wastes comprising computers and computer parts, electronic devices, mobile phones, entertainment electronics, refrigerators, microwaves, TV, fridges, and industrial electronics that are obsolete or that have become unserviceable is growing. All these electronic devices contain plastics, ceramics, glass, and metals such as copper, lead, beryllium, cadmium, and mercury and all these metals are harmful to humans, animals, and the earth. Improper disposal only leads to poisoning the Earth and water and therefore all life forms. Our effort is meant to preserve the environment and prevent pollution by proper handling of e-waste. While it will take a lot of effort to educate people to dispose of such wastes in the right way, we are doing our part by providing a channel to collect e-wastes and dispose off them in a sustainably safe manner. We convert waste to usable resources.

The electronic industry is not only the world's largest industry but also a fast-growing manufacturing industry. It has been instrumental in the socio-economic and technological growth of the developing society of India.

At the same time, it poses a major threat in the form of e-waste or electronics waste which is causing harmful effects on the whole nation
e-waste is creating a new challenge to the already suffering Solid waste management, which is already a critical task in India.

5.5.3 Electronic goods/gadgets are classified under three major heads:

White goods: Household appliances,

Brown goods: TVs, camcorders, cameras etc.,

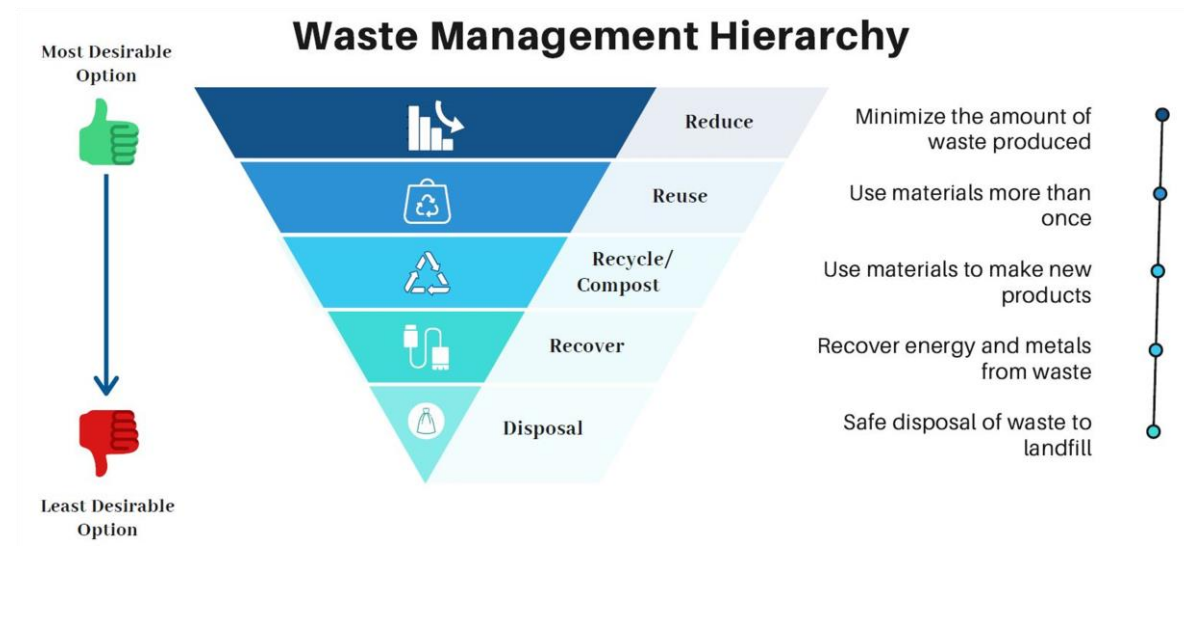Grey goods: Computers, printers, fax machines, scanners etc.

The complete process is carried out as per the government guidelines.

5.5.4 E-waste Management Process

- Collection of e-waste from all the electronic stores, manufacturing companies, etc.
- Transport of e-waste to the disposal units
- Segregation of e-waste at the disposal unit
- Manual dismantling of e-waste to segregate components into various types such as metal, plastics and ceramics
- Convert into raw material (recycle and reuse)
- Supply recovered raw material to processors and electrical/electronic industries
- Dispatch hazardous e-waste for safe disposal

5.5.4 E-waste Management Process (contd.)

Waste management is carried out to ensure that all types of waste and garbage are collected, transported, and disposed of properly. It also includes recycling waste so that it can be used again

Waste Management Hierarchy

Most Desirable Option		
Reduce	Minimize the amount of waste produced	
Reuse	Use materials more than once	
Recycle/ Compost	Use materials to make new products	
Recover	Recover energy and metals from waste	
Disposal	Safe disposal of waste to landfill	

Least Desirable Option

Click/Scan the QR Code to understand E-waste management process

5.5.5 Recyclable and Non-Recyclable waste

Recyclable waste is **renewable or can be reused**. This means that the waste product is converted into new products or raw material, like paper, corrugated cardboard (OCC), glass, plastics containers and bags, hard plastic, metal, wood products, e-waste, textile, etc

Recycling not only conserves important areas in our landfills but also assists decrease greenhouse gas emissions.

Contrary to this, Non-recyclable waste cannot be recycled and cause a major threat to the environment.

The following items cannot be recycled:

Shredded paper, aerosol cans, paper coffee cups, milk and juice cans, used baby diapers, and bottle caps.

Recycling is one of the best ways to have a favorable influence on the world where we live. Recycling will greatly help us to save both the environment and us from pollution. If we take immediate action, we can control this, as the quantity of waste we are accumulating is increasing all the time.

5.5.6 Colour codes of waste collecting bins

Waste collecting bins colour code

India's urban population of 429 million citizens produce a whopping 62 million tonnes of garbage every year. Out of this, 5.6 million tonnes is the plastic waste, 0.17 million tonnes is the biomedical waste, 7.90 million tonnes is hazardous waste and 15 lakh tonnes is e-waste.

According to an estimate, 40% of municipal waste in the city is 'wet' waste, which can easily be composted and used as manure. Nearly 30% of the municipal waste comprises of plastic and metal, which can be sent to an authorized dealer for recycling, and about 20% of it is e-waste, from which precious metals can be taken apart and recycled. However, out of the total municipal waste collected, 94% is dumped on land and only 5% is composted. To gather the garbage two color bin system was suggested. Green bin for wet waste and blue for dry waste. However, there is a drawback in that system. People do through the sanitary napkins and children's diaper along with wet waste causing the contamination of things. Hence the government has come up with three colored garbage collection bins.

1. Green Bin

The green coloured bin is used to dump biodegradable waste. This bin could be used to dispose off wet/organic material including cooked food/leftover food, vegetable/fruit peels, egg shell, rotten eggs, chicken/fish bones, tea bags/coffee grinds, coconut shells and garden waste including fallen leaves/twigs or the puja flowers/garlands will all go into the green bin.

2. Blue bin

The blue coloured bin is used for segregating dry or recyclable left over. This category includes waste like plastic covers, bottles, boxes, cups, toffee wrappers, soap or chocolate wrapper and paper waste including magazines, newspapers, tetra packs, cardboard cartons, pizza boxes or paper cups/plates will have to be thrown into the white bin. Metallic items like tins/cans foil paper and containers and even the dry waste including cosmetics, hair, rubber/thermocol (polystyrene), old mops/dusters/sponges.

3. Black bin

Black bin, make up for the third category, which is used for domestic hazardous waste like sanitary napkins, diapers, blades, bandages, CFL, tube light, printer cartridges, broken thermometer, batteries, button cells, expired medicine etc.

5.5.7 Waste disposal methods:

- Incineration: Combusting waste in a controlled manner to minimize incombustible matter like waste gas and ash.
- Waste Compaction: Waste materials are compacted in blocks and are further sent away for recycling.
- Landfill: Waste that can't be recycled or reused can be thinly spread out in the low-lying areas of the city.
- Composting: Decay of organic material over time by microorganisms.
- Biogas Generation: With the help of fungi, bacteria, and microbes, biodegradable waste is converted to biogas in bio-degradation plants.
- Vermicomposting: Transforming the organic waste into nutrient-rich manure by degradation through worms.

5.5.8 Sources of Waste

1. **Construction waste** – waste coming from construction or demolition of buildings.
2. **Commercial waste**- waste from commercial enterprises
3. **Household waste**- garbage from households is either organic or inorganic
4. **Medical or clinical waste** -wastes from the medical facilities- like used needles and syringes, surgical wastes, blood, wound dressing
5. **Agricultural waste**- Waste generated by agricultural activities that include empty pesticide containers, old silage packages, obsolete medicines, used tires, extra milk, cocoa pods, wheat husks, chemical fertilizers, etc.
6. **Industrial waste**-The waste from manufacturing and processing industries like cement plants, chemical plants, textile, and power plants
7. **Electronic waste**-The defective, non-working electronic appliances are referred to as electronic waste. These are also called e-waste. Some e-waste (such as televisions) contains lead, mercury, and cadmium, which are harmful to humans and the environment
8. **Mining waste**- chemical gases emitted in mine blasting pollutes the environment. And the mining activity greatly alters the environment and nature.
9. **Chemical waste**-waste from the chemical substance is called chemical waste.
10. **Radioactive waste**: radioactive waste includes nuclear reactors, extraction of radioactive materials, and atomic explosions.

5.5.9 Wastes-Source of Pollution

All these above-mentioned waste also adds to environmental pollution.
The contaminants that cause detrimental change to the environment are called pollution. It is one of the most serious problems faced by humanity and other life forms on our planet. The earth's physical and biological components have been affected to such an extent that normal environmental processes could not be carried out properly.

5.5.10 Types of Pollution

Types of Pollution	Detail/Pollutants involved
Air pollution	▪ Solid particles and gases mixed in the air cause air pollution ▪ Pollutants: emissions from the car, factories emitting chemical dust, and pollen
Water pollution	▪ Water gets polluted when toxic substances enter water bodies such as lakes, rivers, oceans, and so on. They get dissolved in it and cause it unfit for consumption. ▪ Pollutants that contaminate the water are discharges of untreated sewage, and chemical contaminants, release of waste and contaminants into surface
Soil pollution	▪ It is the presence of toxic chemicals (pollutants or contaminants) in soil, in high enough concentrations to pose a risk to human health and/or the ecosystem ▪ Sources of soil pollution include metals, inorganic ions, and salts (e.g. phosphates, carbonates, sulfates, nitrates),
Noise pollution	▪ Noise pollution happens when the sound coming from planes, industry or other sources reaches harmful levels ▪ Underwater noise pollution coming from ships has been shown to upset whales' navigation systems and kill other species that depend on the natural underwater world
Light pollution	▪ Light pollution is the excess amount of light in the night sky. ▪ Light pollution, also called photo pollution, is almost always found in urban areas. ▪ Light pollution can disrupt ecosystems by confusing the distinction between night and day.

UNIT 5.6: Organizations' focus on the Greening of jobs

Unit Objectives 🎯

At the end of this unit, you will be able to:

- Understand the concept of ESG
- Explain the different factors of ESG

5.6.1 What is ESG?

The ESG is the short form of environmental, social, and governance. ESG guidelines are used to evaluate businesses on how well they control emissions, governance, human rights, and other factors of their business.

Several companies audit these companies for ESG compliance. They will let the companies know how well the ESG policies are implemented in their company hat let companies know how well their ESG policy is working.

Every business enterprise is deeply intertwined with Environmental, Social, and Governance (ESG) issues. ESG has been looked at seriously by the corporate, government establishments and stakeholders.

ESG is important as it creates high value, drives long-term returns, and global stakeholders are paying attention to the topic.

ESG is said to have created high value, and focuses on long-term returns, and stakeholders are focusing more on this concept.

5.6.2 Factors of ESG

Several factors are used to determine how well a business is doing in maintaining its ESG policies. For creating the ESG Policy, thorough knowledge of these factors are critical.

The factors are divided into three categories; environmental, social, and governance. Knowing about these factors come a long way in designing the effective ESG policy.

Environmental

Environmental factors relate to a business's impact on the environment. Examples include:

- Usage of renewable energy
- Effective waste management
- Policies for protecting and preserving the environment

Social

Social factors relate to the people of the organization. How they are treated in the organization is what it focuses on. The major entities are the stakeholders, employees, and customers. Examples include:

- diversity and inclusion
- proper work conditions and labor standards
- relationships with the community

Governance

Governance factors relate to the company policies for effectively running it. They include:

- tax strategies
- structure of the company
- relationship with stakeholders
- payments to the employees and CEO

Every factor is important and matters a lot to the overall rating of the company in ESG compliance. Ignoring one aspect in favor of another can affect the rating and in turn the reputation of the company.

The companies make a clear communication about these policies to all the employees, and to the public, they should mention what their various activities are that will protect the environment, people, and the governing factors.

Exercise

1. ESG stand for _____, _____, _____.
2. Governance factors include _____, _____, _____, _____.
3. The three causes of air pollution _____, _____ and _____.
4. Mining waste includes_____.
5. Landfill is a _____.
6. _____,_____ and _____ coloured bins are used for disposing the waste.
7. The plastics cans are trashed in _____coloured bin.
8. _____,_____and _____ are considered as e-Waste
9. _____ part of e-waste is recycled and used again

10. E-waste is made up of hazardous substances like _____,_____,_____ and _____

6. Communication and Interpersonal Skills

Unit 6.1 – Interaction with supervisors, peers, customers, and differently-abled persons

Unit 6.2 – Explain the importance of developing sensitivity towards disabled persons

TEL/N9102

Key Learning Outcomes

At the end of this module, you would be able to
- Understand what is communication and the importance of communication in the workplace
- Understand effective communication and communicate effectively for success
- Discuss types of communication -verbal and non-verbal
- Communicate at workplace
- Communicate effectively with superiors
- Communicate effectively with colleagues and customers using different modes viz face-to face, telephonic and email communication
- Understand the hurdles for effective communication
- Conduct professionally at work place
- Respect differences in gender and ability
- Communicate effectively with person with disabilities
- Respect for disable people

UNIT 6.1: Interaction with supervisor, peers and customers

Unit Objectives ⊚

At the end of this unit you will be able to:

1. Understand the importance of communication

2. Understand type of communication

6.1.1 Why is Communication Important?

- Communication Skills are more important than ever, for all fields of endeavor.

- Whatever the role a person is holding in the organization, having a firm grasp of effective communication will undoubtedly be a key role in the individual's as well as the organization's success

- Oftentimes, people with excellent technical skills don't get promoted to higher roles because of their inability to communicate effectively

- Hence one fundamental skill everybody should be proficient along with the technical skill is *Communication Skills*

- Effective communication help us to build rapport with the customer both internal and external and help us *resolve issues* and *conflicts* easily and quickly.

6.1.2 What is Communication?

- Communication is the process of sending and receiving information among people.
- It is imparting or exchanging of information by speaking, writing, or using some other medium
- The purpose of communication is to convey your thoughts and opinions to others.
- Communication is said to be successful only when both the sender and the receiver perceive it in the same way.
- In your personal and professional life, you would be communicating with the following people-
    - Colleagues
    - Customers
    - Friends
    - Parents
    - Relatives

6.1.3 Effective Communication

Effective communication is the process of delivering messages to a target audience in a way that guarantees satisfactory reception and understanding. If the communication is effective, both the sender and the receiver will share the same information at the end of the process. Effective communication is about more than just exchanging information. It's about understanding the emotion and intentions behind the information

6.1.4 Effective Communication for Success

Effective Communication is critical to a business's success. From top to bottom, among colleagues, from subordinates to superiors, and from the organization to the outside, several messages are delivered daily. All the people must communicate these messages properly. Content, language, remarks, tone of voice, and non-verbal communication are elements that affect the effectiveness of messages

Clear and effective communication will

▪ Increase customer satisfaction

▪ Bring more business to the company

▪ Increase productivity among team members

6.1.5 Types of Communication

Communication has been divided into two types:-

• Verbal Communication

• Non-Verbal Communication

Verbal communication takes place when people exchange words with each other, either spoken or written. It includes the **choice and use of words and language to convey a message**. Examples of verbal communication are face-to-face conversation, telephonic conversation, and a speech or presentation.

| Speech | Face to face communication | Phone conversation | Voice chat over internet | Newspapers, e-mails, etc. |
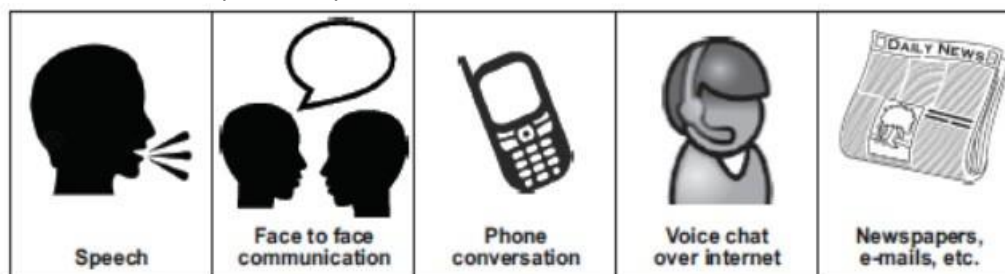
Click/Scan the QR code to know more about types of communication

Speech has certain characteristics which will affect the message that is being spoken:

- Volume – loud speech may sound bossy, very quiet speech cannot be heard.
- Tone – use warm tones without sounding over-friendly. Cool tones are very unwelcoming.
- Pace – fast speech is not easy to follow. Speak at a reasonable pace so that the other person has a chance to understand.

Correct body language also plays an important role in effective communication. For example, a warm smile accompanying 'Have a nice day' or looking directly at the person who is being spoken to give a positive image of the organisation.

Non –Verbal Communication

Non-verbal communication includes the overall body language of a person. There are two kinds of non-verbal communication:

1. **Signs and symbols:** for example pictures, or notices, or signboards, or even photographs, sketches and paintings. Here are some examples of different signs and symbols:

2. Gestures **and expressions:** hand signs, facial expressions, body postures or body language that can help to convey a message. You can learn to communicate better with others if you learn to recognise some of these.

   Facial expressions - A smile or a frown

   Gestures - movements of hands and body to help explain or emphasize the verbal message

   Body posture - how we stand or sit. Maintain a good posture. When you are talking to a colleague or guest, remember to stand up straight, look professional and be positive. Do not slouch, lean against something or fidget with equipment or your hands.

   Orientation - whether we face the other person or turn away

   Eye contact - whether we look at the other person and for how long

   Proximity - the distance we are from a person

   Head nods - for encouragement, indication of agreement or disagreement

These non-verbal clues are important as they can be used to improve the quality of communication. They can be used to reinforce any verbal communication; for example, leaning forward and looking at the person you are speaking to and smiling naturally. Your expressions, posture and appearance must be appropriate and should tell the guest that you are professional, competent and willing to help.

6.1.6 Communication at workplace

In every situation, while interacting with people, we make use of both verbal and Non-Verbal Communication. It is the key to the success of any organization. Be it communication with customers, supervisors, or peers. In today's scenario having technical skills alone is not enough to get the work done, but communication skill is also equally important. Completing the task must require the support of the whole team, and without proper communication, it cannot happen. Effective Communication helps managers to perform their jobs and responsibilities and it serves as a foundation for planning.

6.1.7 Communication with supervisors

Effective and open communication within a team will build a common purpose among team members that will allow them to reach their goals. Team leaders know that group communication enhances organizational efficiency. The team members should always follow the communication guidelines. Some of the points to remember while interacting with supervisors:

1. Be aware of the communication guidelines of the organization.
2. Understand and interpret clearly, the work requirements from the supervisor.
3. Keep the supervisor informed about the progress of the task assigned.
4. Participate in all the discussions which call for decision-making, and provide facts and figures
5. Give/ accept suggestions during the discussions.
6. Accept the feedback positively and work towards rectifying errors if any. Make sure the same mistakes are not repeated.

6.1.8 Communication with colleagues & customers

- The main responsibility is to handle customers' concerns
- Interaction with colleagues/peers is also equally essential and it enhances productivity in the workplace.
- Be polite in speaking to your peers at the office.
- Value other people's time as much as you value your own.
- Before you begin discussing something, ask your coworker if it is the right time to talk, and give a true picture of how much time you expect to take. Always start the conversation
- Communication with colleagues/customers can be through face-to-face, telephonic, or email.
- Keeping a few points in mind while communicating will make the interaction pleasant and fruitful.

Click/Scan the QR code to know more about communication with colleagues and customers

6.1.9 Face-to-face Communication

This is an important medium of oral communication, wherein two or more persons talk to each other and see each other physically. This form of communication is direct or straight. Things to remember while you are communicating face to face

1. Adjust the tone of voice, don't be too loud
2. Make eye contact
3. Use appropriate language
4. Maintain adequate distance
5. Acknowledge, nod during interaction
6. Use appropriate non-verbal gestures to communicate with persons with disabilities

Benefits of face-to-face communication
1. Instant feedback
2. Information conveyed clearly
3. Build rapport

6.1.10 Telephonic Communication

Another widely adopted mode of communication is through the telephone. This is the person-to-person conversation where nobody sees others but hears each other and interacts instantly. Nowadays mobile phones are becoming more popular along with landlines as a mechanical media of oral communication.

The following suggestions are recommended to follow while making telephone calls-

1. Make the call at the appropriate time
2. Provide details about your identity like name, company, department, etc.
3. Discuss the purpose of the call
4. Think about the tone of your voice
5. Listen carefully
6. Speak clearly
7. If you don't understand something, ask
8. Use please, thank you, sorry wherever necessary
9. Follow the organization's policies and procedures while interacting on the telephone.

Click/Scan the QR Code for mor information on telephone communication

6.1.11 Email Communication

Email or Electronic mail is a method of exchanging messages using electronic media. The official or business communication between colleagues or inter-department communication usually happens through email. The advantage of email is you can send communication to many people at the same time.

Points to remember in email communication

1. Be clear and concise
2. Keep the content short and to the point
3. Avoid using jargon and short forms
4. Re-read the message, before sending it for grammar and spelling mistakes
5. The subject line should describe the main mail content
6. Use readable font size (don't keep it too small)
7. Add signature at the bottom of the mail body
8. Check the attachments for viruses before sending

6.1.12 Importance of timely completion of tasks

Time is a major factor that evaluates **the success or failure of a project**. Even when the whole team has done a wonderful job and produced high-quality results, with half the cost allotted to the project, everything will be a waste if it was not delivered on time. Any deviation from the timeline will call for a penalty and sometimes may result in losing the project and eventually the customer. so adhering to the timeline is important when it comes to any organization who are into products and services.

Benefits of adhering to timelines:

1. Increased and improved customer satisfaction
2. Increased productivity and efficiency of the individual
3. Team feels motivated
4. Sense of adhering to the SLA's and Standard Operating Procedures
5. Shows the commitment toward the work and the organization
6. Good word of mouth from the customers

6.1.13 Standard Operating Procedure

A *Standard Operating Procedure (SOP)* is a standardized process that outlines a set of detailed instructions to help workers perform complex tasks properly and safely. The main objective of standard operating procedures is to develop an effective quality system and comply with industry-specific regulations and standards. Failure to follow SOPs can cause significant errors in operations and services.

For a mobile repairing center, the SOP defines the different process of operations, namely handling customer, repairs, sales and interaction among the staff within the repair center.

SOP also clearly defines the responsibility of each and every designated person in the organisation and what is expected from them. It further defines what the various levels of engineers will handle with respect to the handsets coming for repair.

The escalation matrix specifies how the different levels escalate the issue to the next level and adhere to the timelines for repair and communication to the customer.

SOP is created keeping in mind the customer satisfaction as a main motive.

Each and every person in the organisation is expected to read the SOP thoroughly and work accordingly. Because every customer when they go for purchasing a product, one of the main things they see is the post-sales Support. If they find the brands deliver good service support then they don't mind even spending few extra moneys.

6.1.14 Escalation Matrix

Escalation matrix is made up of several levels of contact based on the specific problem at hand. This is being followed by all who are working on that product and have to adhere to the service guidelines. And the problem has to be closed at a minimum turnaround time, and for any reason the repair is taking time proper reason has to be mentioned and notified to all the people concerned including the customer.

6.1.15 Escalation Mechanism

Customer service is a very important aspect of a typical service industry. Giving committed service to customers every time and on time is very crucial for the success of the brand. In recent times, customers do research on how the after-sales support of a product is, and based on that rating they will decide which brand to buy. If the customer service is not good, they will not go for that product even though the product is very good. Hence customer service is a second important aspect of a product and services organization.

For electrical home appliances, the customer logs a complaint and the service engineer is sent to the site for looking into the problem and repairing.

For electronic devices like mobile phones and tablets, the customer is expected to take the product to their service center to get it checked and repaired.

The resolution time matters a lot, as mobile phones have become an indispensable device for people. Their business cannot function without that. Hence too much downtime is also not good. Once at the service center, the technicians at L1 level look for the problem and try to resolve it. If it's beyond their area of resolution the same is escalated to the next level. Every organization has *Standard Operating Procedures* clearly state the workflow for the repair of the smart phones. Every individual working there must be aware of the same and adhere to the deadline for faster service and enriched customer satisfaction.

6.1.16 Escalation through CRM

Customer Relationship Management is a software, through which most of these companies who are into customer service, manage their customers. The customer details are entered in the system and also the services which are logged against a particular customer. This is the automated system, which takes a particular action after a period of time. For example, if a service request is assigned to an engineer for rectifying a problem of a client, and if the engineer does not update the status of the service in the system within a specified period of time, the problem is automatically escalated to the next level for resolution. Then the new engineer who is responsible for resolving pick it and try to find a solution. This system helps to maintain a track of a particular problem and the current status which will help the organization in effectively managing the customer queries. The complete escalation route is mentioned in the SOP and the same is implemented through the CRM software. This eases the manual escalation procedure which is time consuming and slow.

6.1.17 Escalation issues at work

Whether an issue arises among team members or with customers, sometimes the severity of the circumstance requires an escalation to management. Understanding how to approach an escalation can help you better find a solution when conflicts arise. We explore what it means to escalate an issue in the workplace and provide tips for how to do so successfully.

What does it mean to escalate an issue at work?
Escalating an issue in the workplace is the process of bypassing those involved by contacting upper/senior management. It involves raising awareness of the context to the right people in order to resolve a challenging situation. Typically, escalation occurs when there is an issue that the current staff working on the problem can't resolve and requires assistance from those with more authority and resources

When should you escalate an issue at work?
Deciding when to escalate an issue depends on the amount of risk it can bring to the company. Because escalating an issue can lead to difficult meetings and cause disruptions in work, you should reserve them for issues that truly require escalation. You can often avoid escalating an issue by solving the problem with the individual first.

However, some issues require support from those with higher authority. Consider escalating an issue at work when:

- You have already tried other strategies but that did not work.

- Resolving may incur additional cost to the company or the customer, while rectifying the problem.

- Because of the non-availability of certain parts the repair work is taking longer than usual.

- The engineer broke another part while repairing a part. So escalation is required to get the approval to replace the broken part by the company.

6.1.18 Hurdles for Effective Communication

Following are factors contribute to communication not being effective.

Stress and out-of-control emotion. When you are stressed or emotionally disturbed, you're more likely to misread other people and send confusing non-verbal signals. Calm down before continuing the conversation.

Lack of focus. You can't communicate effectively when you're multitasking. If you're checking your phone, planning what you're going to say next, or daydreaming, you're almost certain to miss nonverbal cues in the conversation. To communicate effectively, you need to avoid distractions and stay focused.

Inconsistent body language. Nonverbal communication should support what is being said, not contradict it. If you say one thing, but your body language says something else, your listener will likely feel that you're being dishonest. For example, you can't say "yes" while shaking your head no.

Negative body language. If you disagree with or dislike what's being said, you might use negative body language to ignore the other person's message, such as crossing your arms, avoiding eye contact, or tapping your feet. You don't have to agree with, or even like what's being said, but to communicate effectively and not put the other person on the defensive, it's important to avoid sending negative signals.

6.1.19 Professional Conduct

There are six basic rules to be followed for professional conduct:

- **Be on time:** Being late impedes a company's operations and demonstrates a lack of consideration of the time concerns of others. If you are constantly late for work, meetings, or are always late with your reports and other tasks; it demonstrates to others that you are probably not executive material because you disregard the value of time.

- **Be discreet:** Keep company secrets such as new product designs, sales figures or any other confidences to yourself.

- **Be courteous, pleasant, and positive:** No matter how demanding your clients, customers, co-workers or employees might be; always remain upbeat and positive. Projecting a positive company image has the same effect.

- **Be concerned with others, not just yourself**: Finding out a customer or client's point of view naturally helps you get ahead in any industry. Concern for others should include your superiors, co-workers and subordinates as well.

- **Dress appropriately:** Dress to be comfortable in your environment. Dressing poorly or too casually does not convey a good image, neither does overdressing, which breeds suspicion and mistrust, and will be seen as inappropriate.

- **Use proper written and spoken language:** People who can express themselves clearly are at an advantage. This goes beyond using good grammar, proper spelling, and appropriate diction in all your communications; you should also speak and write to the point.

6.1.20 Respect Gender Differences

In any business, be it a small company to a big corporate, the workforce is a mix of both genders. The ratio of men vs. women varies from 70:30 or 60:40. Studies show that business teams with an equal gender mix perform significantly better than male-dominated teams when it comes to both sales and profits. No two women or men are alike and yet at the same time there are some work related traits that are gender specific. Both men and women approach their work in a different way and deal with many hurdles that come their way. Since they all share the same workspace every organization has devised a policy as to how they treat the opposite gender at the workplace and what are the implications of any abuses

Some of the points to remember while interacting with female colleagues
1. Treat them with respect
2. Support them in case they approach you
3. Value their opinion and suggestions
4. Involve and include the opposite gender in all the discussions

Unit 6.2: Explain the importance of developing sensitivity towards disabled persons

Unit Objectives ⌖

At the end of the unit, you will be able to

- Respect differences in gender and ability
- Communicate effectively with person with disabilities
- Respect people with disability at work

6.2.1 Communication with Disabled Person

A **disability** is any condition that makes it more difficult for a person to do certain tasks or interact with the people around them (socially or materially). These conditions, or defects, may be cognitive, developmental, intellectual, mental, physical, sensory, or a combination of multiple conditions. Defects may be present from birth or can be acquired during a person's lifetime. Often, disabled people are excluded from full participation in any activity."

But things are changing; every organization has allotted some percentage of employees from this section of the society. They are also allowed to exhibit their skills in a few jobs which they can perform without putting their life at risk

General tips for communication with disabled people

1. Speak to them as you would speak to anyone else in a soft and low tone.

2. Respect the person first, not their disability. For example, use the term 'a person with disability' rather than 'a disabled person'.

3. Do not use phrases such as 'suffers from' and 'crippled' rather the phrase should be 'people who use a wheelchair' rather than 'wheelchair bound.

4. Don't drag or push a person's wheelchair, and don't move their crutches or walking stick without their permission. It has to be in their personal space.

5. When talking to a person who is in a wheelchair, try to sit in such a way you could reach their eye level. This would not strain them much, to lift their head and talk.

6.2.2 Communicating with people with a hearing impairment

Keep these points in mind while interacting with people with a hearing problem

1. Draw the person's attention before you speak. Give a gentle tap on their shoulder, a wave of some other visual signal to the person's attention
2. Stand in front of the person and maintain eye contact
3. Don't cover the mouth while talking. They can figure out what is being said by just looking at the lip movement
4. Speak at a normal pace don't speak fast or slow
5. Choose the words wisely
6. Use short sentence
7. Be gentle while speaking don't raise the tone

6.2.3 Respect people with disability

Learn the proper way to act and speak around someone with a disability.

1. Do not use offensive or derogatory words like 'handicapped', 'crippled', and retarded etc.
2. Don't criticize or blame them. Don't shout at them or use abusive language
3. Talk slowly with a low tone. Pause while talking
4. Avoid excessive whispering, joking and laughing unnecessarily
5. Assuming things about them or their situation.
6. Don't make jokes about their condition or be sarcastic
7. Don't look down upon them because of their disability
8. Appreciate them for their efforts and work, and motivate them to perform better

6.2.4 Safety at workplace for people with disability

Disabilities of all types affect employees and can pose various mental or physical challenges. In many situations, a disability may impact the amount of time it takes for an employee to complete a task or get from one part of a facility to another. Some disabilities may be known while others remain unknown to an employer.

Health and safety legislation should not prevent disabled people from finding or staying in employment so it should not be used as an excuse to justify discrimination against them.

Disabled people and those with health conditions, including mental health conditions, should be given the opportunity to both get into and stay in work.

Responsibilities of an employer towards disabled people

The employer is responsible for the health, safety and welfare of all of their employees, whether they have a disability or not.

Disability is not always obvious so one might not realise a worker is disabled or they might choose not to tell you, particularly if their disability has no impact on their ability to do their job.

Workers do not have to tell anybody unless they have a disability that could foreseeably affect the safety of themselves or anyone else connected to their work. If they do not reveal and there are no obvious indicators of any disability, then the organization are not under any obligation to make workplace adjustments.

Periodically, consult with the employees (whether directly or through their representatives) on issues relating to health and safety. These discussions reflect good safety practice because employees have day-to-day understanding of the job, so they are likely to have good ideas on keeping themselves and others safe.

6.2.5 Workplace adaptations for people with disability

Few changes in the workplace to make it a safe place for the disable people will go a long way in the employee satisfaction for an organisation.

Workplace Adaptations

Workplace should be easily accessible for these people with special needs. One major compliance concern deals with accessibility. For example, if workplaces have been adjusted or created more accessible entrances and exits to their facilities, allowing more independence for persons in wheelchairs, would be a great idea. Other subtle changes may include the width of bathroom stalls, hand rails inside the stalls and long ramps instead of stairs. The path of travel that employees take should never be obstructed; there should be no barriers to prevent someone from getting to safety in an emergency.

Workstations easily can be adapted to follow this universal design. Many companies now use slide-out keyboard trays and monitors on swinging arms to allow employees to adjust to their needs. Desks can accommodate wheelchairs in place of regular chairs, and general work spaces can be lowered to allow easier access. The main goal is to remove all barriers and allow everyone to concentrate more on completing their tasks.

The biggest challenge with universal design is accommodating the multitude of challenges that different disabilities present. Not all disabilities are the same, and not all will present the same challenges for employees. Some employees may have issues with their right hand while others have issues with their left. For some, it may involve not being able to stand or sit. Some may need low lighting, while others need bright lighting. Designing a facility to accommodate all is always going to be a challenge.

Complying with government guidelines can be more difficult in regards to employees with disabilities. This difficulty lies with ensuring that employees are aware of all hazards in the workplace. Multiple disabilities will create multiple reasons that may keep employees from recognizing hazards. Employees with impaired vision, for example, must have other means of identifying hazards. This may be remedied with audible alarms or touch-activated devices that warn employees not to go in an area. Other employees may have difficulties reading and may benefit from shapes or colors to further identify hazardous areas. For workers who lack hearing ability, employers can utilize signs to demonstrate hazards or use flashing strobes to identify when employees need to evacuate an area and head to safety.

Every organization has to make few adaptations in order to make it a better place to work even for people with disabilities. It should provide an environment where they feel they are safe and can carry out their work rather than worrying about their safety.

Exercise

1. What are the three points you will focus on when you talk to people face to face?

   _____

   _____

   _____

   _____

   Fill in the blanks

1. Before sending the mail it's important to check the _____ and _____ of the content.

2. When you interact through phone, provide your identity details like _____,_____ and _____

3. Add your _____ at the bottom of your mail.

4. The Customer Care Executive is mainly responsible for handling _____.

Notes

Annexure

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